Vol. 14 OCTOBER, 1920 No. 2

QUARTERLY

OF THE

National Fire Protection Association

Entered as second-class matter May 1, 1911, at the Post Office at Boston, Mass. under act of July 16th, 1894.

87 MILK STREET, BOSTON, MASS.

National Fire Protection Association.

(INTERNATIONAL.)

Executive Office, 87 Milk Street, Boston, Mass., U. S. A.

October, 1920.

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Western Actuarial Bureau (Fire).
Western Canada Fire Underwriters' Association.
Western Factory Insurance Association.
Western Insurance Bureau.
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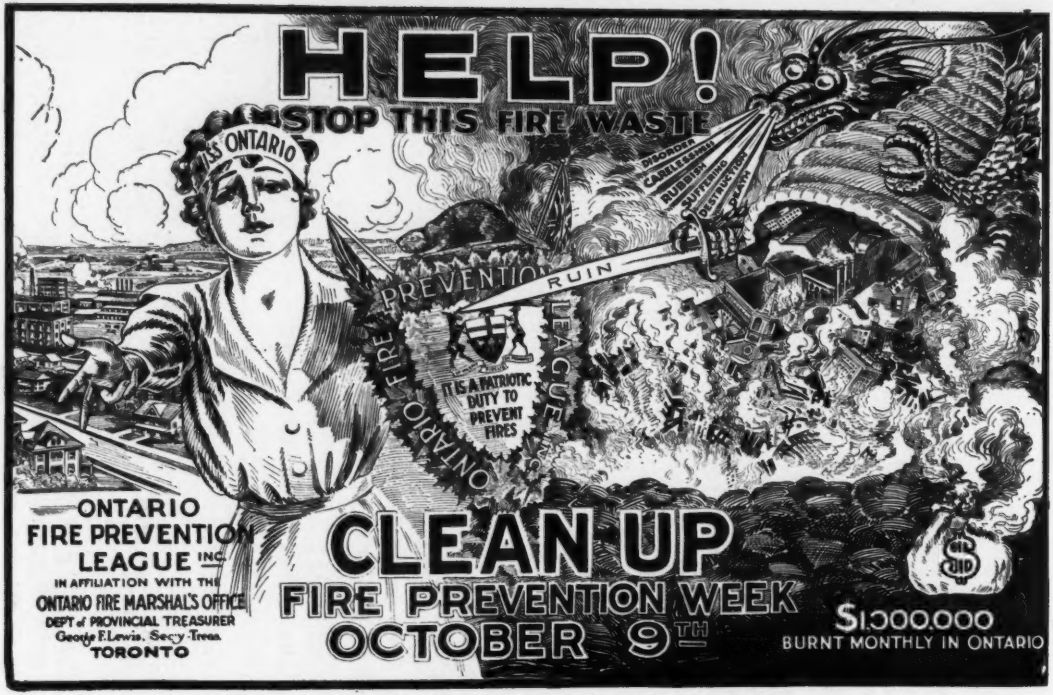
Reports of fires appearing in the Quarterly are copies of or extracts from written reports forwarded to the Association. This Association, as a body, is not responsible for the statements or opinions of any of its members.



Reproduction in black and white of colored poster circulated in Canada by the Ontario Fire Prevention League.

The Quarterly

Vol. 14. October, 1920. No. 2.

Getting Into Her Stride.

The convention, October 5th, of the Ontario Fire Prevention League in the Parliament buildings, Toronto, while a provincial effort, will echo throughout the Dominion. Ontario's forceful fire marshals, E. P. Heaton and his deputy, George F. Lewis, are awakening the Canadian people. Canada is going to check her fire waste. She is even now getting into her stride. With a more democratic government than the United States, a crying national need does not have to cut through so much political brush to reach the open country. Canada needs to reduce her fire losses; so she goes ahead provincially and nationally to do it; provincially, as in Ontario, by liberal expenditure of provincial funds in intensive education, and nationally by legislation making a preventable fire a crime, and at the same time supplying expert advice to citizens or communities who want it.

Speaking recently in St. Thomas, the Dominion fire commissioner, J. Grove Smith, said:

> We have a national debt of $2,400,000,000 and a population of about 8,000,000, and the burden occasioned by such a debt has to be carried by that population. It is imperative that we stop all channels of waste; we must be more careful if we are to exist as a nation and carry on.

If these figures are correctly reported, the conclusions drawn from them by Mr. Smith are indisputable, and as this is an actual condition and not a theory the Dominion government tries to think of some practical way to serve; and finds it. The government employs a waterworks engineer in the fire commissioner's department to advise with the municipalities and help solve their immediate water problems, and an engineering force to take up and improve by advice and counsel the fire protection of individual plants producing Canadian goods. Says the fire commissioner:

> During last year my department, by request, made surveys of over 200 manufacturing concerns in Canada. Sprinkler systems were installed in over 90 of these factories. In some instances the insurance rate was as high as $4.25 before protection, and after protection the rate was lowered to 60 cents. The saving made by putting in that protection paid for the system in nine months of its installation. In the majority of cases the cost of installation will be entirely wiped out by the saving on insurance premiums within a period of something like five years.
>
> If there is in your city or town a building, or property, or structure that you think should be sprinklered, send along to my office the names and addresses of the property owners, nature of business, and the estimated amount of insurance

carried, and we will send to your town an engineer who will make a complete survey of this building. He will then furnish the property owner a detailed estimate of what it will cost to bring the protection of that property up to our standard, and also an estimate of the insurance rate that can be got after protection.

In 1912 to 1915 Canada's annual fire waste was $23,000,000. In 1916 it leaped to $33,925,000, largely due to war risks. Last year it dropped again to $24,000,000, and this year the fire preventionists are hopefully setting $20,000,000 as the limit, while realizing that even this sum is a grievous burden for a country of only 8,000,000 people. Nobody who was at Toronto in October 5th will doubt that Canada is going to quit following the example of the fire nation across the border. She knows the fire waste is impoverishing her, and she is no longer content merely to talk about it.

* * * * *

The Fool-Killer Again on Vacation.

Just as we conclude the whole breed of cranks of the sort who know they can extinguish conflagrations with a can of heavier-than-air gas has been exterminated, and turn to engineering problems that can be solved, somebody leaves the door open, and in bobs another of the same kidney.

Our genial friend, Goodwin Lee of New York, who just naturally attracts interesting matter for the columns of his *Fire Engineer* from the friends who love to gossip with him, has printed a letter from F. A. Raymond, of our Committee on Signaling Systems, which it is fun to read. Mr. Raymond says:

The other day a prominent manufacturer of electrical apparatus handed me some documents with the request that I examine them and give him an opinion as to the practicability of and market for the devices indicated. The papers included letters from a promoting concern and a copy of a U. S. patent.

On examination, I found the device was an old familiar friend in new garb; no less than the old scheme of the anti-false alarm fire alarm box or, as it was called by the patent office, The Person-Retaining Alarm Device. The idea of a fire alarm box which will catch hold of the person sending the alarm and keep him at the station until the fire department, police or others in authority have arrived is almost as old as the fire alarm box itself, and certainly as old as the first malicious false alarm. It is so old and has been re-invented so often that there is a list of some forty odd devices of this kind for which patents have been issued.

Such devices were at one time used considerably in some of the smaller cities, notably in the Middle West, and it was one of the common amusements in these small places (almost as common, in fact, as the old one of posting a letter in the fire alarm box) on a Saturday night to raise a cry of fire, and induce some innocent farmer or other stranger to send an alarm; the "safety" box would catch his wrist or arm and hold him while the gang would go through his pockets and relieve him of his watch, change, tobacco, etc.

I will not write any dissertation on the iniquity of the U. S. Patent Office taking the good money of inventors in return for worthless patents, which are the more worthless in proportion as they successfully perform the work expected of them; and I will only advert to the nerve of people who try to sell such schemes to reputable manufacturers. *Caveat emptor.*

But just think what the predicament of a man who sees a fire break out in a corner store would be, and who goes to the adjacent alarm box to send in an alarm and finds himself held a prisoner while the flames are shooting out around him; or imagine the plight of the father of a family, awakened in the middle of the night by fire, who runs to the fire alarm box and is held there a prisoner, while he hears the shrieks of his wife and babies in the distance.

Of course, those who actually send in false alarms are not deterred by such schemes, but provide themselves with a suitably shaped piece of wood or metal or other such article, and send in the false alarms just the same. It is only the honest citizen who gets in trouble, and yet inventors persist in inventing and trying to market such fool devices.

* * * * *

More Scriptural Fire Prevention. That distinguished member of the N. F. P. A. old guard, Fred E. MacKnight, now of Atlanta, and all the time of our Committee on Automatic Sprinklers, was reading on page 7 of the July QUARTERLY how Robert Palm of New Jersey came to the rescue of Professor Woolson at a critical moment with a quotation from the Bible that put the N. F. P. A. Philistines to never-ending flight; and being on his way to New York by the Southern railroad and expecting to have plenty of time to read, he put his Bible in his hip pocket, which was empty, and before he got to Greenville he had found so much fire prevention in the Hebrew text he thought he was reading *Field Practice*. But he was in for a revelation that did not appear in the chapters of that name, but in the Book of Kings. Fred had been brought up to believe that all fire prevention engineering ideas had originated with Edward Atkinson, having been told so when he was in Boston, and what he considered the greatest discovery of all was the idea of self-releasing floor timbers which, when they burned through and let the floor loads go, slid out and did not wreck the walls. And then he read this in the first Book of Kings, chapter 6:

> For outside in the wall of the house he made narrowed rests around about that the beams should not be fastened in the walls of the house.

And after Fred had pondered on this from Greenville to Salisbury, rather a long time, he found that his reverence for Edward Atkinson had not abated, only he had come to admire him as a Bible student instead of an engineer.

School Children as Fire Wardens. Our Philadelphia member, Richard H. Morris, in discussing at a meeting of the Fire Prevention Committee of the Chamber of Commerce the subject of fire prevention education in the public schools, suggested that the plan frequently followed in Fire Prevention Week of a pupil's report on home conditions be made a regular feature of every week in the year. Mr. Morris writes:

> The idea I had was to preach in all public schools the doctrine of fire prevention in the home and to make the individual pupil responsible for the condition of his home in the simple matter of order and neatness, particularly in the cellar, the keeping of matches, etc., making it his duty on Saturday mornings when he is at home to take the few minutes necessary to clean up, and bring to school on Monday morning a very brief report card filled out,—this card, of course, being of a standard prepared by someone of experience, and each year on Fire Prevention Day to reward the pupils who have made the best weekly reports for the year,—possibly an inexpensive prize or button or merely public commendation.
>
> In other words, have Fire Prevention Day the culmination of the year's work in this respect.
>
> I believe that this plan, if well thought out, would get not only the interest but the continued support of children, and lodge in the minds of most of them the seed of care and watchfulness in this respect, which might in the future sprout when they became employees or employers in the world of work.

There is no doubt of the virtue of Mr. Morris' suggestion, or that if it were adopted and actually administered the plan would effectively supplement and fortify our text book method of instruction. The difficulty in most places would lie in the unwillingness of the school authorities to give the necessary attention to the matter. The school routine is in many places glutted with topics loaded upon it by zealots in educational specialties. The teachers are mostly overworked and burdened with too many pupils.

There is a way, however, in which Mr. Morris' plan might be made to function, and that is to make it almost exclusively a pupils' effort, supervised perhaps by some officer of the fire department who has the leisure for it. The boy scout and camp fire girl ideas have already colored the thought of most school children, and they might easily be led to respond to the leadership of one of their own number acting as monitor or "head fire warden," who might receive their weekly reports and transmit notices of hazardous conditions to the fire chief. If each school should thus have a fire prevention committee of the pupils themselves the teachers would not be burdened with the detail, but would be expected to furnish occasional advice and encouragement only.

Mr. Morris is to take up his plan with the Philadelphia Board of Education, and we may later have the privilege of reporting the success of his endeavor.

* * * * *

The Incendiary Cigarette.

One day last summer, in discarding his cigarette before entering a matinee in Boston, a Harvard student tossed it into the lace dress of a woman in the lobby of the Colonial Theatre. There happened to be a gentleman in the lobby who smacked out with the palms of his hands the fire running in the threads of the lace.

The American fire waste caused by smoking is costing the nation about $45,000 per day. Every fire from this cause is preventable. Every one is started by an unconscious incendiary.

The *Insurance Press*, that capable journal of the underwriting world edited by Franklin Webster, recently made the interesting suggestion that the manufacturers of cigars, cigarettes and smoking tobacco print in large letters on each box or carton an arresting warning against carelessness. Mr. Webster says:

> A vast amount of valuable space on tobacco containers is now either unused or else devoted to unnecessary decoration.
>
> If, for example, smokers, before lighting up, were reminded that they caused a fire damage every minute of $50 or more, it is certain that during that particular smoke they would be careful, and since both carefulness and carelessness are largely mere matters of habit, a habit in the right direction might be formed by this simple expedient.
>
> Or, if mere kindly suggestion is unavailing, then put a little more muscle in the arm of the law. If automobile drivers can be charged varying fines for careless driving, which exposes to hazard only a few lives, surely a penalty should be inflicted upon a careless smoker who jeopardizes possibly the lives of hundreds.

It may very well be that we shall have to seek legislation to curb this recklessness. Anyone who will observe the cigarette butts on sidewalks, in gutters, in car stations, or in every out-of-the-way corner of places where people congregate, will realize the extent of this evil menace. It

is noted that some discarded cigarettes burn their entire length, while in others the fire dies out as in a match stick that has been treated for afterglow. Assuming that differences in the character of the paper wrapper are responsible for this difference in combustibility, and in the hope that all cigarettes might be made slow-burning, an inquiry on the subject was addressed by the National Fire Protection Association to the American Tobacco Company.

The American Tobacco Company did not reply.

* * * * *

The Providence Fire Department. Stories of ignorance of the functions and operation of automatic sprinkler systems are so frequently heard that they excite little comment. But when a fire department deliberately refuses to co-operate in maintaining and restoring sprinkler protection after a fire it is time to show more than passive interest. One of our members has recently reported a fire in Providence, where, although the story falls somewhat short of the Toonerville fire department's substitution of bottled soda water for extinguisher soda, nevertheless some of the doings would be quite humorous if not fraught with such serious potential consequences. Our member reports:

"The Fire Department, upon arrival at the building and finding that the fire had been extinguished by the sprinklers, started to shut off the water. They closed every valve in the entire sprinkler system, except the valve shutting off sprinklers in the building where the fire started and had been extinguished by the sprinklers, and where the water was still flowing at about 300 gallons per minute. It is reported that the elevator valves and steam valves were closed by the department, thinking that they were sprinkler valves. Before the proper valve was closed 15,000 gallons of water poured into the building. Then the fire department returned to their headquarters, leaving water shut off the entire plant. . . .

"In Providence, when the fire department responds to a fire in a sprinklered property, they return to their quarters after the fire is extinguished, leaving water shut off sprinklers. We have tried to have the Providence Fire Department restore the sprinkler system after a fire, but the Commissioners have declined to do this."

This report speaks for itself — no further comment is necessary, except, perhaps, to add that all this happens in the home city of one of the largest manufacturers of sprinkler equipments in the world.

* * * * *

The Delineator's Egregious Blunder. No more mischievous editorial blunder has been perpetrated in many years than the printing of the articles, "You Can Dry Clean," by Ruth McNary Smith, of which the first appeared in *The Delineator* for October, the Butterick publication issued for the edification of middle class women.

Twenty-five years of public education, a fire waste of $250,000,000 per annum, and a yearly death toll of 25,000 human beings, principally women and children, are matters the knowledge of which has not yet penetrated the editorial brain of this magazine.

Says Miss Smith, in her ingenuous effort to encourage the wife and mother to her death:

The chief reason for poor results is that the amateur cleaner is too economical with gasoline. Gasoline is to the dry cleaner what water is to the launderer. To get good results, not pints but gallons are necessary to carry on the processes of soaking, washing and rinsing. It is, therefore, an economy to save soiled garments

for a wholesale cleaning day, for which one provides not less than three gallons of first-grade gasoline.

Miss Smith also gives friendly advice as to straining gasoline through chamois and storing it in bottles and cans, and completes her mischievous counsel by declaring that the home cleaning closet should contain *alcohol, benzine* and *ether.*

When one reflects upon what precautions are taken in the arts and industries in which these volatiles are used, and what severe restrictions the municipalities hedge about dry-cleaning establishments, Miss Smith's opening paragraphs in which the dangers of the use of gasoline are recited seem very simple indeed. She refers artlessly to the "fumes of gasoline exploding when they become warm."

To encourage dry cleaning in the home, no matter what accompanying warnings may be given, is almost criminal foolhardiness. The mere having gasoline about and handling it is the danger. Women and children somewhere are certain to suffer a horrible death as the direct result of Miss Smith's ill-considered articles, and the amazing ignorance of *The Delineator's* editors in publishing them.

Executive Committee Approves Fuel Oil Rules.

The *Executive Committee* has *voted* by letter ballot to approve the action of the *Committee on Inflammable Liquids* on those sections of the *Regulations for the Storage and Use of Fuel Oil and the Construction and Installation of Oil Burning Equipments where a Competent Attendant is Constantly on the Premises,* which were referred to the Committee by the annual meeting. The amendments are as follows:

Article **4. Venting of Tanks,** *Paragraph* (b), *first sentence to read:* "Vent openings shall be screened (40 x 40 non-corrodible wire mesh or its equivalent, preferably cone shaped), and shall be of sufficient area to permit proper inflow of liquid during the filling operation, and in no case less than 1¼" in diameter."

Article **8. Setting of Tanks,** *Paragraph* (c), *second sentence to read:* "The floor immediately above the tanks shall be of reinforced concrete at least 9" in thickness or some other type of construction of equivalent strength and fire resistance, extending at least one foot, etc."

Article **31. Valves,** *Paragraph* (b), *add:* "In installations where the pump is located at a distance from the burners, it is advised that remote control device be installed so that the supply of oil can be cut off at the pump in case of accident."

Section VI. Dampers, *omit* Article 37, *but retain* Note.

The amended report is *approved,* and the Regulations as amended are *adopted* for promulgation.

The Fire Fighters' Future.

The proposition of the Dominion Association of Fire Chiefs to establish a training school for firemen at Ottawa is interesting as an indication of quite a radical change in sentiment among the Canadian fire chiefs in a very few years. A similar recent change of outlook may be noted among the fire chiefs in the United States. Not only has the idea of fire prevention, as important a matter as fire extinguishment, rapidly developed among them, but the scientific and theoretical facts they have absorbed in fire prevention effort have stimulated a review of their practices and methods of fire extinguishment in the hope of making this branch more efficient also.

Undoubtedly the most successful first effort in this direction of fire-fighting schools was that of New York City, where the name "fire college" was adopted, which has since been generally accepted as the proper designation of such establishments. The New York authorities have been very generous in opening their school to the firemen of other cities both in the States and the Dominion, and a study of the various and intricate fire-fighting problems of the great metropolis has been of incalculable benefit to the men of other departments, for the method has been to place the visitors right in the fire stations, where they might run to fires with the apparatus, and even help in handling it, as well as to attend the formal study classes and lectures by the fire department officers.

But fires are not confined to the large cities, and the problems which confront the men of the small departments, paid, part-paid and sometimes volunteer, are naturally not completely solved in a big city like New York. The International Association of Fire Chiefs was designed to provide an educative function, but has never been able to develop its possibilities in this direction so far as the rank and file are concerned. The Chiefs have undoubtedly derived benefit from the annual interchange of ideas, but smaller sectional bodies even of the Chiefs—the Pacific Coast Association, for example — have seemed able to tackle fire-fighting problems more aggressively. The plain firemen and the volunteers have with varying success attempted organizations of their own, sometimes with other than plain fire-fighting as their objects.

There are many fire chiefs in North America who admit the advantages of education for their men, and some of further education for themselves in view of new and developing industrial processes and fire hazards, and are willing to consider any feasible plan for receiving instruction from outside sources. The first State official to recognize this need and to seek means of meeting it seems to have been Fire Marshal James R. Young, of North Carolina, who some ten years or so ago took a young and active chief from the Raleigh fire department and attached him to the fire marshal's office as instructor, letting it be known that any fire department in the State might have the services of this instructor for the asking. After a few years of this increasingly popular service to the

municipalities, Mr. Young planned annual State conferences at which the chiefs might gather for mutual instruction and interchange of ideas.

A movement of this latter sort was inaugurated in 1919 by Fire Marshal George H. Nettleton, of Minnesota, who called a fire prevention congress in St. Paul, and tried the experiment of conducting a "fire college" at the same time. The success of the plan was sufficient to induce Mr. Nettleton to repeat it this year, and he has hopes the college and its course of instruction may eventually become a State institution. Naturally at these meetings both fire prevention and extinguishment are taught, the latter including instruction in physical training, ladder scaling, rescue work, first aid, hose exercises and the use of modern apparatus and appliances. Lectures on gas masks and other subjects incident to the profession are given.

In Chicago a plan is in operation which makes the fire department itself a continuous training school so far as the officers are concerned. Chief John C. McDonnell's capable and praiseworthy administration of the fire department's bureau of fire prevention attracts to service in that bureau the most ambitious and clever young men in the uniformed force, for from the men who make good in the bureau service—fire prevention—are selected the officers of the fire-fighting brigade. It is hard to conceive of a better plan than this to bring the best intelligence into command of the companies.

George F. Lewis, the capable deputy fire marshal of Ontario, said to the Dominion fire chiefs assembled in St. Thomas in August:

> Conditions are changing. A great many hazards have come into your fire-fighting life that did not exist a few years ago. These hazards have to be met and overcome, and to do this the establishment of a Fire College will be of great benefit for the purpose of training the men. The time is not very far distant when your Departments will be called upon to use your efforts and time more largely for the prevention rather than the extinguishment of fires. Times are changing and conditions are such that a Fire Chief is today largely judged by the fewer number of fires and the less amount of loss sustained in the municipality under his jurisdiction than in the more spectacular work of the old days. We have in every community much to overcome in order to cut down our excessive fire losses, and in the work of fire prevention the Fire Chief should be the person to take the initiative.

J. Grove Smith, fire commissioner of the Dominion, was also present at the St. Thomas convention, and pledged the sympathetic co-operation of the government in any effort the uniformed firemen may make toward fitting themselves to better meet their responsibilities to their cities and to the Dominion.

These developments in Canada, North Carolina, Minnesota, New York and Chicago, although differing in method, all demonstrate the recognition of a positive need, and forecast a changing condition in public fire departments. Not only the fire chief, but the hoseman and engine driver, are eventually to occupy the place in public esteem their important function warrants. These public servants have always been admired for their frequent deeds of heroism; the day is coming when they will be properly respected for their superior knowledge of a recognized difficult profession, when they cannot be replaced by incompetent political pretenders, and when their compensation, standards of life and living conditions will be on a level with those of men rendering similar service to private industry.

The Ince Trophy Contest.

The Pacific Coast Association of Fire Chiefs has at their September meeting awarded the Thomas H. Ince Trophy for the first six months of 1920 to Anaconda, Montana, Charles Collins, chief of fire department. Other cities received favorable mention in the order named, as follows: Piedmont, Cal., Chief Culver; Los Angeles, Cal., Chief Scott; Oakland, Cal., Chief Whitehead; Pasadena, Cal., Chief Coop.

The Pacific Coast Association of Fire Chiefs, through its president, Elliott Whitehead of Oakland, Cal., backed up by the executive committee of the Association, inaugurated in January, 1920, a competitive fire prevention contest with the express purpose in view of saving human life and conserving property interests. Mr. Thos. H. Ince, proprietor of the Ince Moving Picture Studios, hearing of this contest and desiring to give it all the aid and encouragement possible, produced an educational film to instruct the public as to the common fire hazards existing in the home and industrial plants. He also offered a handsome silver cup, costing at least $500, as a prize to be given to the city showing the best fire prevention efficiency in the campaign inaugurated. Within the cup is placed a "bunch" of 250 silver dollars donated by the Fire Prevention Bureau of the Pacific, for the benefit of the members of the fire department of the city which succeeds in winning the prize.

This contest is open to all of the cities and towns of California, Oregon, Washington, Idaho, Montana, Utah, Nevada, Arizona, New Mexico, British Columbia, Manila, and the Hawaiian Islands. The first prize period was the first six months of 1920; succeeding periods are to be for one year, beginning each July. The cup goes to the winning city, to remain there until the next year's award, when it goes to the new winner. The cup will be permanently awarded to the city which wins for three years, not necessarily consecutive. The cash prize, however, will go each year to the winning city, and will be replaced for the next award by the Fire Prevention Bureau of the Pacific.

The original rules of the contest, subsequently modified to permit some late entries during the initial six months' period, are as follows:

A. Any city wishing to enter must file notice with the president of the Association not later than 60 days after the first of January, 1920, or for later years not more than 60 days after the first day of July of the year they wish to enter, it being understood that the first period will extend from January 1 to June 30, 1920, the next beginning July 1, 1920, for a period of one year until 1921, and so on thereafter in one-year periods.

B. The awards are to be made at the annual convention of the Pacific Coast Association of Fire Chiefs, and by a secret ballot of the convention. The president will appoint a committee of three members who are practical men and not competitors in the contest. The committee will select not less than three nor more than five reports to be submitted for vote of the convention. The report of the winning city is to be checked by a committee of three persons named by the presi-

THE THOMAS H. INCE TROPHY.

The figures on the cup represent the fire and police departments, the teacher, citizen and boy scout united to prevent fires. The drawing on the cup is taken from a painting of the San Francisco conflagration.

Thomas H. Ince presenting the cup to Chief Collins of Anaconda, Montana.

dent of the association to see that it is correct; if not, the prize is to go to the city submitting the second best report, which also must be checked, which checking process shall continue until a report is secured which is found to contain no misrepresentations.

C. The prize is to be awarded to the city making the best showing in fire prevention activities during the year, which showing is to be placed before the committee in the form of a report by the fire chief of that city and based on the following activities:

1. **Reduction in losses per capita.**
2. **(a) Reduction in alarms according to population.**
   (b) Actual fires.
   (c) False alarms.
3. **Arson activities; the number of investigations, arrests, prosecutions, convictions.**
4. **Public meetings held; estimated numbers present, with whom and where held.**
5. **Number of building inspections made; percentage of the city covered during the year.**
6. **School work; number of meetings, supervised drills, class work, etc.**
7. **Improvements in fire department and public protection, to include apparatus, water mains, hydrants, etc., during the year of competition only.**
8. **Success in securing co-operation of public officials.**
9. **Boy scout and other fire department auxiliaries organized.**
10. **Activities in publicity and fire prevention legislation.**
11. **HAVE ANY LIVES BEEN LOST OR PERSONS INJURED AS THE RESULT OF PREVENTABLE FIRES OR FALSE ALARMS.**

The competitive reports will be compared with each city's record for the preceding five years.

D. The first prize will be a cup donated by Thos. H. Ince, to be known as the "Thos. H. Ince Cup," together with a cash contribution of $250 from the Fire Prevention Bureau of the Pacific. The cup will be taken to the city which wins the same and kept there during the ensuing year, and the name of the city, the name of its fire chief, and the year will be engraved thereon. The $250 is to be removed from the cup at this time and placed in a benefit fund or mutual aid society for the fire department in the city which wins the prize. If there be no benefit fund or mutual society in the said fire department, the chief shall exercise his own judgment in placing the $250 where it will be of the most benefit to the members of his department as a whole. The cup is to be returned by the chief at the next annual convention, to be re-awarded after the $250 has been replaced by the Fire Prevention Bureau of the Pacific.

E. Additional prizes may be given from year to year in the form of special prizes donated by firms or individuals for the best showing made by any city in a specified state, provided announcement is made and the president of the association notified not later than 60 days after the beginning of any award period.

The cause of fire prevention on the Pacific Coast will receive a further stimulus during the second period of the contest through a prize, taking the form of a flag, to be awarded to the school in each state which shows the most pronounced activity and greatest efficiency in fire prevention. These flags are donated individually by the Governors of the several states, as follows: Hon. W. D. Stephens, California; Hon W. D. Davis, Idaho; Hon. S. V. Stewart, Montana; Hon. Ben. W. Olcott, Oregon; Hon. Simon Bamberger, Utah; Hon. Lewis F. Hart, Washington.

For the first period of the contest there were one hundred and ten cities entered. It is expected that the number of entries will increase for succeeding periods. Those entered for the first six months of this year are as follows:

ARIZONA

Phoenix	Prescott

CALIFORNIA

Alameda	Hercules	National City	San Francisco
Albany	Lodi	Oakland	San Jose
Berkeley	Long Beach	Pasadena	San Rafael
Calexico	Los Angeles	Piedmont	Santa Ana
Chico	Martinez	Riverside	Stockton
Dinuba	Modesto	Sacramento	Vallejo
Emeryville	Monterey	San Anselmo	Venice
Fresno	Napa	San Diego	Ventura
Fullerton			

IDAHO

Blackfoot	Idaho Falls	Lewiston	Sand Point
Boise City	Jerome	Nez Perce	Spirit Lake
Caldwell	Kellogg	Pocatello	Wallace

MONTANA

Anaconda	Butte	Havre	Miles City
Billings	Glasgow	Lewistown	Wolf Point
Bozeman	Great Falls		

NEVADA

Tonopah	Reno

OREGON

Albany	Corvallis	Lebanon	Oregon City
Ashland	Grants Pass	McMinnville	Pendleton
Astoria	Harrisburg	Medford	Portland
Baker	Heppner	Merrill	Salem
Bend	Hermiston	Mountangle	Seaside
Carlton	LaGrande	Newberg	Tillamook

UTAH

Bingham Canyon	Copperfield	Midvale	Salt Lake
Bountiful	Logan City	Ogden	Toole
Brigham City			

WASHINGTON

Asotin	Davenport	Montesano	Seattle
Bellingham	Everett	Olympia	Spokane
Camp Lewis	Garfield	Palouse	Tacoma
Centralia	Hillyard	Ritzville	Yakima
Chehalis			

BRITISH COLUMBIA

Vancouver

The report by Chief Collins of the Anaconda, Montana, Fire Department, the winner of the Ince Trophy for the first period, illustrates to good advantage the various features of the contest. The summary and report by Chief Collins are as follows:

ANACONDA, MONTANA, FIRE DEPARTMENT FIRE PREVENTION BUREAU.

Fire Prevention activities and Fire Record from January 1 to June 30, 1920, in comparison with the preceding five years:

FIRE LOSS

Total Fire Loss	**$180.00**	**Showing a reduction of**	**98½%**
Insurance Loss	**None recorded**	**Showing a reduction of**	**100 %**
Fire Loss per capita	**.01½c**	**Showing a reduction of**	**98½%**

ALARMS

Total Alarms	**17**	**Showing a reduction of**	**81%**
False Alarms	**4**	**Showing a reduction of**	**86%**
Fires of Unknown Origin	**None**	**Showing a reduction of**	**100%**

During this year we have not had an occasion to use a line of hose, and only used chemicals three times.

ARSON ACTIVITIES

Arson activities have been improved 100%, as we have not had an occasion for an investigation, arrest, prosecution or conviction, having located the direct cause of each alarm.

CASUALTIES

Our casualties have been reduced 100%, as we have had none this year.

I believe that the statistics will show that this record has never been equaled by any city which is as compactly built of combustible material as is Anaconda.

WATER SYSTEM

Extensive improvements have been made in our Water System this year, increasing both volume and pressure sufficient for any emergency.

Our inspection systems have been improved 100 per cent this year. We have made over 9,000 inspections, which covered the entire city, including basements, warehouses, stores, theatres, garages, schools, manufacturing plants, lumber yards and shops. In fact, no place has been overlooked where there was a possibility of an accumulation of combustible material, Our inspections have been thorough and systematic, under the direction of our City Inspector, Dennis Shovelin, and the firemen. During the year we have had approximately 800 wooden boxes and barrels replaced by metal containers for ashes. The results are that we have not had an ash or rubbish fire this year. A reduction of 100 per cent.

The installation of a tape register in connection with the fire alarm system to insure accuracy in receiving alarms, the purchase of 1,000 feet of new hose, along

with our full complement of modern apparatus and appliances, place our department on a high standard of efficiency. Other benefits for fire prevention have been accomplished by the installation of numerous chemicals, general and auxiliary fire alarm boxes, fire ladders, escapes, etc.

During the year we organized an auxiliary to the fire department known as the Fire Prevention Bureau of Anaconda. This bureau was not organized for a temporary campaign. It is a permanent organization, and we believe it to be the most thoroughly organized and successful bureau of its kind to be found in any city.

Through this bureau we have accomplished wonderful results. We have interested the public in co-operating with the fire department in fire prevention work, and have proven that fire prevention can prevent fires. Through the efforts of this bureau we have made vast improvements in the schools of our city by interesting and receiving the co-operation of the members of the school board, the superintendent, principals and teachers, who have readily complied with all suggestions and recommendations regarding fire prevention lessons, meetings, lectures, and fire drills, and protecting the schools from a fire hazard standpoint by ordering auxiliary fire alarm boxes, additional hose and chemicals, where needed, and many other minor improvements.

Through the courtesies of the state auditor and fire marshal's offices we procured the services of Jay W. Stevens, manager of the Fire Prevention Bureau of the Pacific, for a series of lectures and pictures. During his meetings, Mr. Stevens lectured and showed fire prevention pictures to over 5,000 men, women and children. These were the most successful fire prevention meetings ever held in our city. When leaving Mr. Stevens said, in part: "To you who live here the fact may not appear unusual, but to me it seems almost unbelievable; it is without a doubt the cleanest city I have seen in my travels, and your fire record is wonderful. Rest assured that wherever I go I will have a boost for the cleanest and most sanitary city of them all."

Mr. Stevens interested the public in fire prevention to such an extent that we have now over 6,000 co-operative members in our bureau, including the Board of Fire Underwriters, city officials, merchants, industrial plants, theatre and garage owners, labor organizations, fraternal societies, the American Legion, boy scouts and the press of our city, which has been more than generous in backing up our fire prevention work. And last, but not least, the women are on the job all the time. After looking over our exceptionally clean city and our almost perfect fire record for this year and note the wonderful results obtained, the most severe critic will have to admit that fire prevention is worth while.

Sisal Fire on a Concrete Pier.

Galveston, Texas.

By H. H. Sutton.

(Member N. F. P. A.)

If any additional data were necessary to show that there is no construction which may be termed "fireproof," the fire which occurred on May 31, 1920, on the upper floor of one section of a four compartment reinforced concrete wharf warehouse, the contents being principally baled sisal, would furnish that necessary evidence. This fire started on the upper floor of the outer section of a four section concrete warehouse, located on Pier 41, Galveston, Texas, property of the Galveston Wharf Company. The general arrangement is shown by the photograph (Fig. 1). The picture shows the outer section, "D," where the fire originated and was confined; a part of section "C" appears at the left.

The contents of section "D" consisted of baled sisal* valued at $1,095,000, and steel cotton ties, representing a value of $102,500. The insurance loss was about $1,000,000.

The section of the building in which the fire occurred may be considered a total loss ($250,000), and under the present building costs cannot be replaced for that amount; the expense involved in clearing away the wreckage, which will be large, must also be considered in the replacement cost.

Construction.

Pier 41 was constructed in 1916 by the Galveston Wharf Company to conform with the best known practices in reinforced concrete construction. Walls consisted of 8-inch reinforced concrete fillers between reinforced concrete column and girder construction; floor and roof slabs were of mushroom construction, roof slabs 6 to 8 inches thick, with 3-inch depressed panels; second floor slab 9 to 12 inches thick, with 3-inch depressed panels; both carried on round reinforced concrete columns 16 inches in diameter second, and 22 inches in diameter first, spaced 20 feet on centers, with column caps measuring 4 feet 6 inches; depressed panels 8 feet square. First floor was 3-inch wood plank on earth fill. Expansion joints were left half-way in east and west walls (across wharf) of Section "A," and north of the 12-inch reinforced concrete fire division walls between Sections "A" and "B," "B" and "C," and "C" and "D." This feature will account for the fact that the fire was not communicated

* Note: Sisal, a coarse grade of hemp, otherwise known as ixtle, sisal grass, or herequin, is a hard fibre obtained from the leaves of the agave, and is grown principally in the State of Yucatan, Mexico. The bales, which are held together with sisal ropes, will average nearly 400 pounds in weight, being about 4 feet long, 3 feet high and 3 feet wide.

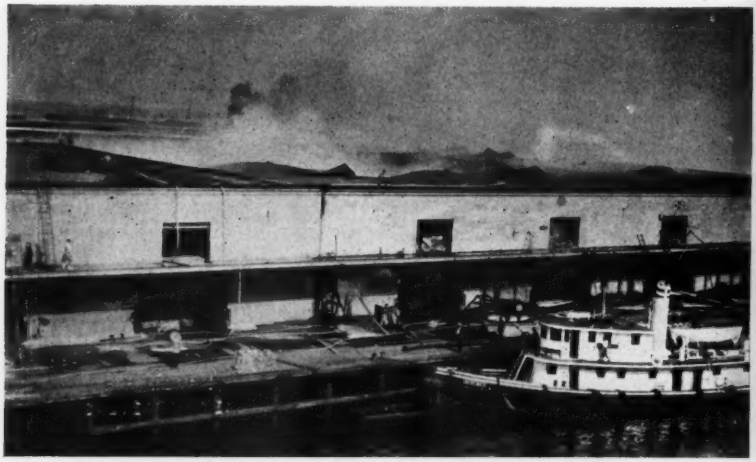


Fig. 1. Pier 41, Sections C (left) and D (right), showing collapsed roof of Section D. The tug "Berenice" (at right) with three other fireboats and tugs supplied several hose lines. This picture is taken from an adjacent pier.

into Section "C" from Section "D" when the roof and floor slabs collapsed, as they were not bonded to the fire division wall. Skylights with metal louvred sides and wired glass in metal frame, size 10 x 10 feet, 2 feet high, were located: seven in Section "A," nine in Section "B," nine in Section "C," and ten in Section "D." Wood apron on north and east sides on first floor and concrete awning on second on east and west sides, with railroad switch track on west awning; *no communicating openings between floors.*

Fire Protection.

The private fire protection installed in the section which was lost consisted of four 2-way frostproof standard fire hydrants with same threads as Galveston Fire Department hose, on the first floor, *inside building*, having from 50 to 200 feet of 2½-inch cotton rubber-lined hose attached, and six 3-inch risers to second floor having 50 to 100 feet of 2½-inch hose attached, with some nozzles missing, as was indicated in an inspection which was made the previous April; fire hydrants and inside standpipes were fed by a 6-inch cast-iron main in the form of a loop system around the property, connected to a 10-inch main of the City of Galveston distribution system. Two ADT combination night-watch and fire alarm boxes were located on each floor of Section "D," with hourly rounds maintained for the full twenty-four hours.

Story of the Fire.

The watchman who was on duty at the time of the fire is shown by records in the ADT central station to have reported from the box in the northwest portion of second floor of Section "D" at 4:06 p. m., and he

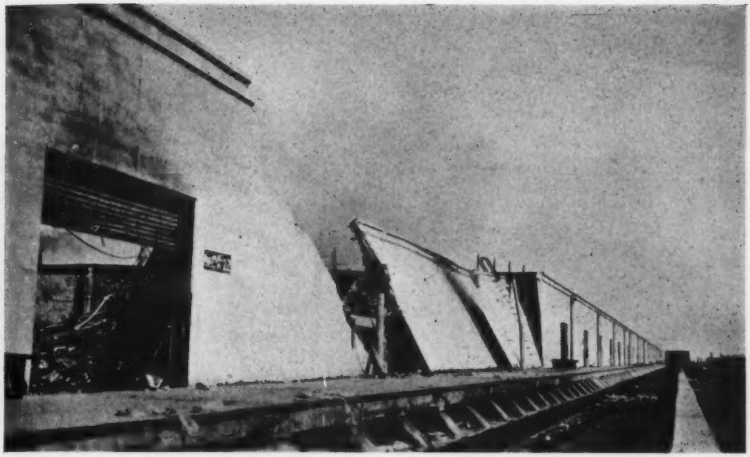


Fig. 2. Collapse of West Wall second floor. This photograph is taken from the west second floor concrete awning, on which the railroad track runs (track shows at right of picture). This view, taken from near the end of the pier, shows the collapsed Section D in the foreground, and in the distance towards the shore, the uninjured sections C, B, and A

states that at that time there was no indication of a fire on that floor. At 4:53 p. m., as nearly as can be determined, the crew of a vessel which was docked alongside the pier at this warehouse saw smoke issuing from the doorways on the second floor of this section. A telephone alarm was transmitted immediately, and the watchman turned in an alarm over an ADT box located in Section "B," which was promptly relayed by the central station office employees, as is shown by the punching register tape at the office of the fire chief in the City Hall, which shows that the first round of box 453 (Pier 41's dummy box number) was received at 4:55 p. m. Response made by the fire department was reasonably prompt, but the efforts of the watchman and others before the arrival of the fire department apparatus and of the firemen after their arrival were rendered practically valueless because of the rapid spread of the fire, the fact that the baled sisal stock had been stored without proper aisleways and had been tiered to within a few feet of the roof, and that the rolling metal doors in exterior walls were closed and could be opened only from the inside.

There were soon 18 lines of hose laid, five 2½-inch lines and one 3-inch line from the fireboat "Charles Clark," which is equipped with two 1500 G. P. M. Underwriters' fire pumps, two lines each from the tug "Hughes" and the derrick barge "Ajax," one line from the tug "Berenice," two lines from automobile pumper, and five gravity lines from the fire hydrants located on the first floor of this compartment.

The firemen were further handicapped by the smoke caused by the preparation in which the steel cotton ties had been dipped, as sisal burns with an intense blue flame with very little smoke, according to best in-

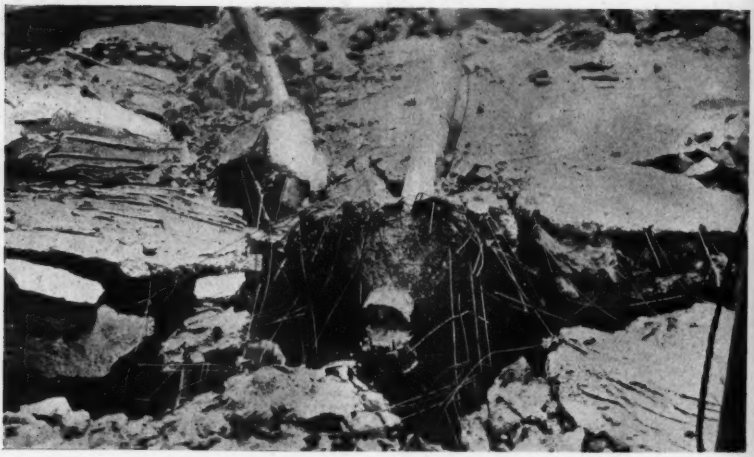


Fig. 3. Column failure and Wreckage of Roof Slab.

formation obtainable. The fire was not under control for a couple of days, and the sisal was still smoldering on June 25th.

Cause.

The cause of this fire has not been definitely determined, but spontaneous combustion and the action of the sun's rays through one of the glass skylights, similar to a burning glass, have been advanced.* The theory developed is that during one of the squalls, which are frequent at this time of the year on the Texas coast, one of the skylights developed a leak, allowing the wetting of the stock immediately under same, and that the heat produced by the direct rays of the sun at a later date supplied sufficient heat to produce the fire, which, when first observed by the watchman, was apparently under one of the skylights.

Conclusions.

It has been generally accepted that each floor of a reinforced concrete constructed building, with no openings between floors, may be considered a separate fire area for underwriting purposes. There is conflicting testimony as to the time fire was first noted on first floor, some stating that the sisal stock was on fire there before the collapse of the second floor slab, and if their testimony is correct as to the white heat of the floor slab between the first and second floors, this is possible, for stock was tiered in places to within a few inches of the ceiling of the first floor. (Similar conditions obtained in the other sections at the time of fire report, June 8th.) The Galveston fire chief states, however, that there was no fire on the lower floor until the roof collapsed at about 11:30 p. m., some six and one-half hours after the alarm was given, and caused the collapse of

* NOTE: Investigations by the Underwriters' Laboratories, not yet completed, appear to indicate that sisal is not subject to spontaneous heating.—ED.

Fig. 4. Detail of column failure.

Fig. 5. Fire wall between Sections C and D from second floor level.

the floor slab between the first and second floors at that point where it was already heavily loaded by the storage of the cotton ties.

An examination of the ruins of the concrete fails to disclose a single instance where the protection for the reinforcing was not as required, and from the large fragments in evidence after the failure, it is deemed that the mixture was extremely good.* The columns failed generally at a point some six inches below where the flare started for the column cap. This fire demonstrates that regardless of the character of the construction of the building, if a sufficiently hot fire can be produced by contents, there are no building materials which can withstand it successfully.

The points of interest brought out by this fire are that such large areas without proper segregation of values by the erection of standard division fire walls should not be permitted without the installation of automatic sprinkler equipment having water supplies of adequate pressure and heavy volume; that with similar storage (cotton or hay) proper aisle-

*NOTE: Enquiries addressed by the N. F. P. A. Executive Office to both the designers and the builders of this warehouse have failed to secure any authoritative data as to the aggregates and mixture used. The best information available seems to be a personal "recollection that the concrete was what is commonly known as a 1:2:4 mix and that both gravel and crushed limestone were used as a coarse aggregate in various parts of the structure, depending upon the materials available."

ways should be maintained, not only through the stock at regular intervals, but also entirely around the stock against the outside walls; that tiering should be restricted; that hourly watch service is inadequate; that means of quickly opening doors leading into the sections should be provided from the outside; that first aid appliances located inside building are of little value; and that the design of reinforced concrete fire division walls should be given careful study by fire protection engineers.

NOTE.

Since this fire the City Council of Galveston has passed an ordinance regulating the storage of sisal and other similar substances, which became effective August 30. This is reported as follows:

"It shall be unlawful for any person, firm or corporation to keep or store in any building or warehouse within the corporate limits of the city of Galveston any sisal, jute, bagging or other inflammable material unless the same shall be stored so as to leave a space of five feet between the top of such material and the ceiling or roof of the warehouse or building where same is stored, and so as to leave a space of three feet between such material and the walls, doors and windows or sides of buildings so as to allow a clear passageway of three feet in width every fifty feet in such buildings. Also have same guarded day and night."—ED.

Open Sprinkler Protection for Pulpwood Pile.

Lake Superior Paper Co., Sault Ste. Marie, Canada.

The photographs on the opposite page show an excellent application of open sprinkler protection for pulpwood storage—indirect forest preservation. This installation is along the lines suggested in Mr. F. J. Hoxie's article in the July QUARTERLY, entitled "Log Piles: Their Hazards and Protection," but antedates the publication of this article, having been installed in June of this year.

This pile constitutes the entire storage of the company in this locality, and is reserved for winter use. The open sprinkler system shown is operated continuously during the summer months. The wood of this pile will not be removed until winter, and the piping is so arranged that when necessary it can be readily moved. The pile is eighty-five feet high, five hundred and forty feet long, has a maximum width of three hundred feet, and contains approximately thirty-two thousand cords. It is protected by a system of 3-inch feeder mains laid along and around the base of the pile, with ¾-inch pipe laid over the pile connected to these mains at about 20 foot intervals. These ¾-inch pipes are provided at 15 foot intervals with 18-inch extension nipples set vertically. Each nipple is capped with a pipe cap, perforated with four $\frac{1}{32}$-inch holes slightly peened to give a spray.

The system is supplied by an eight stage, motor driven centrifugal pump with 2½-inch discharge. The pump has a rated capacity of 210 gallons per minute discharge against a 250-foot head, but is not being operated at maximum capacity.

Pulpwood pile of Lake Superior Paper Co., Sault Ste Marie, Canada. (See opposite page.) This pile contains 32,000 cords of wood, protected by continuously operated open sprinklers spaced at 15 x 20 ft. intervals.

Lake Superior Paper Co., open sprinklers in operation. (See opposite page and photograph above.) Three quarter inch pipe distributing system. Nozzles are ordinary pipe caps drilled with 1/32 inch holes.

East Brooklyn Oil Conflagration,

Baltimore City, Maryland, July 19, 1920.

By Charles V. Gordon,

Association of Fire Underwriters of Baltimore City.
(Member N. F. P. A.)

This conflagration which started at 12:50 P. M. July 19, 1920, and continued to burn for four entire days following, resulted in the complete destruction of three tanks, Nos. 102, 103 and 104, the laboratory, sample house and garage of the U. S. Asphalt Refining Company; four tanks of the Texas Oil Company, fifteen dwellings, two retail stores, and the East Brooklyn Volunteer Fire Department headquarters on Center and First Avenues.

Construction and Layout.

THE U. S. ASPHALT REFINING COMPANY. Tank No. 102 contained 35,000 bbls. crude oil; tank No. 103, 55,000 bbls. distillate, and tank No. 104, 55,000 bbls. of crude oil. All three were riveted steel on concrete bases with wooden roof covered with felt.

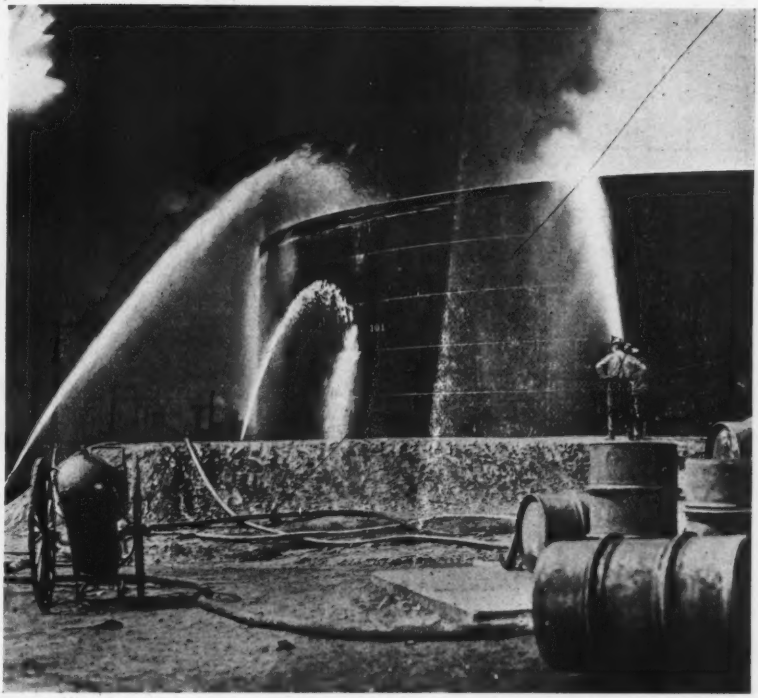
THE TEXAS OIL COMPANY. Two tanks of 55,000 bbls. capacity were of riveted steel and one contained approximately 3,000 bbls. of crude oil and the other empty. Two smaller horizontal tanks were of riveted steel construction, set on frame uprights, and contained about 300 bbls. of gasoline each. The three tanks were each equipped with a 1½" steam jet, but had no electrical ground. All were located within 80 feet of each other, and the dwellings and other property within a distance of 125 feet. The dikes were made of earthwork with a crown of only 6 to 12 inches, a height of from 2 to 4 feet, and the capacities were not equal to the capacities of the tanks. The laboratory was used for testing and experimenting of crude oil samples. It was a one-story brick building, ordinary joist construction, with composition-covered roof and plain glass windows on all sides. The sample house was used for the storage of asphalt samples in small tin containers. The building was one-story corrugated iron on wood frame with composition-covered roof and plain glass windows on all sides. The garage was a one-story frame building with composition-covered roof and normally contained four cars, but was vacant at the time of the fire.

The fifteen small dwellings were two story and the two stores were three-story brick buildings of ordinary construction with tin roofs.

The East Brooklyn Volunteer Fire Department was a two-story frame building with a tin-covered roof and housed the apparatus of the Company which had disbanded.

Protection.

This entire territory has recently been annexed to Baltimore City and is located virtually outside of public protection, there being no public water



Hose Streams Cooling Tank No. 101.

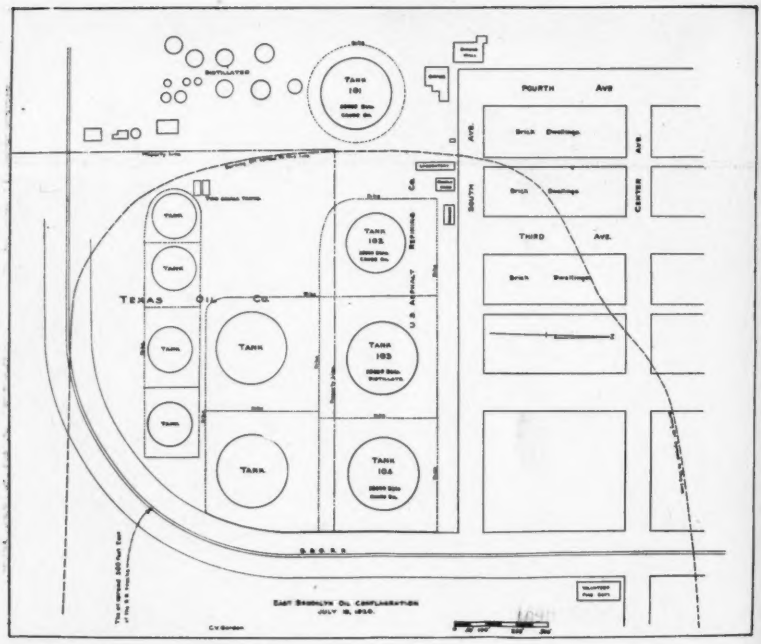
supplies and the nearest Engine Company is at Brooklyn, about three miles distant.

The U. S. Asphalt Refining Company has a private fire hydrant system consisting of 14 hydrants well distributed throughout the property. These hydrants are supplied through 8", 6" and 4" mains, by three pumps of 1200, 900 and 300 gallons per minute capacity, located in one pump house. The pumps have 8" and 12" suction lines from the river. There was about 3,000 feet of 2½" cotton rubber lined hose on reels in hose houses distributed throughout the plant.

No information is available as to the fire protection of the Texas Oil Company.

Story of the Fire.

The fire originated by lightning striking tanks Nos. 103 and 104 of the U. S. Asphalt Refining Company. It was stated by the Superintendent of the Company that the steam jets had been in operation about an hour before the tanks were struck. It would appear that there was not sufficient steam in the tanks to counteract the lightning and ignition of the oil. The resultant explosion caused the tops to be blown up from the tanks and then



East Brooklyn Oil Conflagration—Dotted line shows limit of spread of burning oil.

to settle down inside. Everyone heard the explosion and a silent alarm was sent in from the office of the Company to the Baltimore City Engine Company, located at Potomac Avenue and Fifth Street, Brooklyn, about three miles distant.

The employees of the U. S. Asphalt Refining Company then made efforts to pump the oil from the burning tanks and also started the three fire pumps on their yard hydrant system, maintaining 135 pounds pressure at the pumps. It is reported that they had two good streams of water in action in about ten minutes, keeping the nearby tanks cool.

The suction pipes inside the tanks have an elbow on the open end nearest the center of the tanks, and the other end is connected to a flexible joint in the suction pipe just inside of where it enters the tank, about three feet above the level of the bottom. By a chain attachment to the roof, the center open end can be raised or lowered according to the amount of oil that it is desired to remove from the tank. When the roofs collapsed these suction pipes dropped to the bottom of the tanks and probably became clogged because of the heavy sediment, for the oil pumps could not get suction. Even if the oil could have been removed from the burning tanks, there were no empty tanks available in which to store it.

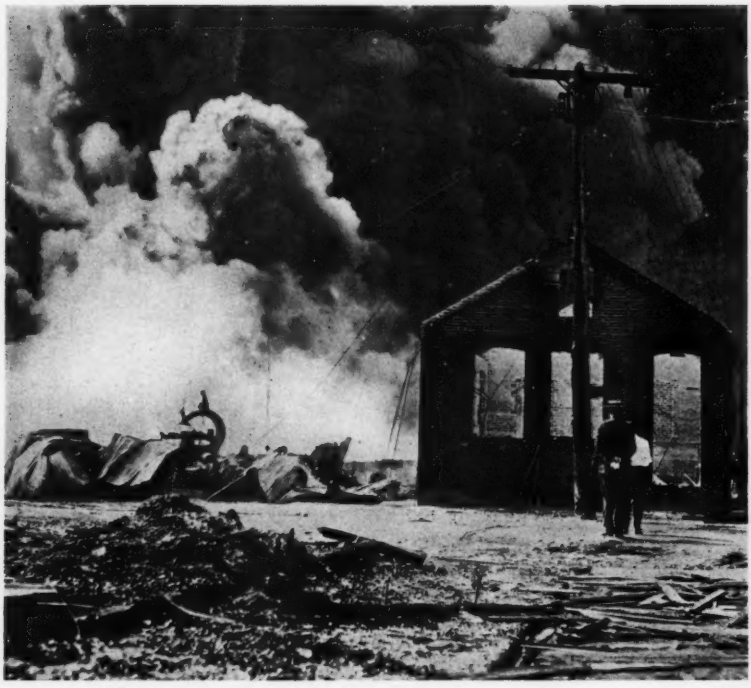
The Brooklyn Engine Company in responding to the fire saw by its large proportions that they would need assistance and in passing the fire

Ruins of Dwellings and Fire in Tank No. 102.

alarm box at Main Street and North Avenue, they sent in a first alarm at 1.00 P. M., and shortly after reaching the scene at 1.06 P. M., sent in the combination second and third alarm.

In about one hour the additional apparatus including two fire boats had arrived from a distance of about six miles, and fourteen hose streams were being used on the nearest tanks and property, especially tank No. 102. Five lines were taken from the Company's private yard hydrants; six lines were supplied by the fire boat Deluge, which was tied up at the Company's pier; two small lines were provided by locomotives of the B. & O. Railroad, taking suction from tank cars, and one line from the gravity tank by which the Martin Wagner Company supplies the dwellings in the town. By these means, and most favorable winds the firemen, up to this point, had been successful in confining the fire to the two tanks in which it started. At 10.11 P. M. the combination fourth, fifth and sixth alarms were sent in for the purpose of bringing more apparatus as well as to relieve the men who were becoming exhausted. This made a total of 22 engine companies, two truck companies and two fire boats on the scene.

About 10.00 P. M. the fire in tank No. 103 began to boil excessively, causing flames of oil vapor to leap 50 to 100 feet in the air. At this time the tanks partly collapsed and the burning oil flowed out and spread quickly



Ruins of Laboratory and Sample House — Tank No. 102 burning.

over the dikes and far into the surrounding property, imperiling the lives of hundreds of firemen, spectators and inhabitants. This flaming mass ignited everything in its path and travelled down grade, stopping only at the water's edge. It also rendered the fire-fighting equipment completely out of service; almost every foot of hose being used was totally destroyed. The fire boats having no more hose and being entirely cut off, pulled out in mid-stream, and the men running the pumps supplying the Ashpalt Company's yard hydrant system were forced to shut down the pumps and leave the pump house, because of the intense heat and danger.

At this time with the fire department helpless, tank No. 102, the laboratory, sample house and garage of the U. S. Asphalt Refining Co., the four tanks of the Texas Oil Co., the East Brooklyn Volunteer Fire Department House, fifteen small dwellings and two stores all took fire and were totally destroyed. Several hundred feet of track of the B. & O. R. R. had the temper drawn by the intense heat.

Without water the fire department was powerless, and they quickly accepted the offer of the U. S. Industrial Chemical Company to supply the water. This company has three 1,000-gallon per minute Underwriters' fire pumps and an excellent yard hydrant system.

A pressure of 115-120 lbs. was maintained in the pump house of the U. S. Industrial Chemical Company with three 1,000-gallon per minute pumps running, and using their hose and the fire department hose, five lines each 1½ miles long were laid to the fire, being relayed twice enroute by pumping engines. These five lines were taken from three hydrants nearest the fire, fifteen hundred feet of the Chemical Company's hose being used. With these streams, the firemen were able to save tank No. 101 by keeping it sufficiently cool; and to stop the flames from their path through the rows of dwellings. At 5.00 A. M. Tuesday morning the pump of the Asphalt Company was again started and supplied two hose streams, used to cool No. 101 tank. The fire was practically under control about 9.00 A. M. Tuesday morning with the fire and remaining oil confined in the dikes around tanks Nos. 102, 103 and 104 of the Asphalt Company, and two large tanks of the Texas Oil Company. The U. S. Industrial Chemical Co., after notifying the firemen, shut off their pumps at 4.45 A. M. Wednesday, and no firemen were on the ground Wednesday afternoon. The fire continued to burn freely for two days in these five tanks and dikes.

Conclusions.

1. The tanks were located about 80 feet apart and the dwellings only 125 feet away, whereas under the standards these distances should have been 200 feet and 400 feet respectively.

2. If an electrical ground connection and a steel roof had been provided the lightning might have been carried off without igniting the oil.

3. The dikes being of sub-standard construction, and having a capacity smaller than that of the tanks, were of little value in obstructing the spread of the oil; although it is the belief that if the dikes had been of standard construction and capacity they would not have contained the boiling oil.

4. A good public water system would have greatly assisted the fire department in stopping the fire as it spread through the rows of dwellings.

5. It seems essential that there should be sufficient tank storage capacity available in which to store any oil that may be removed from a burning tank; but in this particular case it was not possible, as the suction lines failed at the start of the fire.

6. In view of the fact that a swivel suction pipe is quickly damaged in an oil fire, a fixed emergency suction pipe installed above the sediment line would be desirable.

Garage Fire Record.

The registration of motor vehicles in the United States has increased from about 48,000 in 1906 to 7,565,446 in 1919. The increase from 1915 to 1919 has been 5,200,000. The number of automobiles manufactured and placed in service is still increasing in geometrical ratio. In 1919 there was a total increase in registration of 23%, and despite transportation difficulties the manufacturers' estimates for 1920 indicate the largest automobile production in history.

It is a self-evident fact that these automobiles are accommodated in garages, that garage construction has kept pace with the multiplication of the automobile. There are no satisfactory national statistics on garage construction, but automobiles are too valuable to leave in the open exposed to the weather, and it is reasonable to assume that garage facilities have increased in proportion to the automobiles. This mushroom growth of garages continues, unadvertised and unnoticed by the majority. Unlike housing construction, it has not been halted by increased prices or other difficulties. In fact, it is the largely held opinion that the automobile and its attendant extravagances are responsible at least in part for the present housing shortage. Such statistics as are available are not inconsistent with this contention. For example, in one American city for the first six months of 1920 building permits were issued as follows:—Single houses, 1; apartment houses, 2; garages, 114.

Fire experience and municipal legislation have been responsible for great improvements in the modern garage over the converted livery stable and carriage repair shops of ten and fifteen years ago, but there remain many features requiring further betterment. And, with the continuing era of garage construction, there will still be opportunity to incorporate the best features in new garages.

Hazards of Garages.

The accompanying tables are compiled from the reports in the N. F. P. A. Department of Fire Records. Reports only from 1915 to 1920 are included, as the development of the automobile has been such that fires before 1915 may not represent present conditions. The tabulation is subdivided to bring out the most frequent causes of fire. These will be taken up individually.

Gasoline.

Gasoline is the inherent, fundamental hazard of the automobile and its storage and repair. Gasoline itself is not, properly speaking, a cause of fire, although it is frequently reported as such. However, it may be regarded as a contributory cause in the great majority of garage fires. For whatever the primary cause of fire, gasoline usually is responsible for its rapid propagation. The mitigating circumstance is the fact that the

GASOLINE AND OILS AS CONTRIBUTORY FIRE CAUSES.

Cleaning with Gasoline	**14**
Cleaning with Kerosene	**5**
Cleaning with Distillate	**2**
Gasoline in Open Containers	**17**
Gasoline Improperly Drained	**13**
Oils or Grease, on Waste or in Open Containers	**10**

hazard of gasoline is now fairly well recognized, even if not fully realized. Large quantities are not ordinarily present inside the garage buildings except in proper containers (if automobile tanks are considered proper containers). The quantities present, although comparatively small, are, with the inadequate ventilation usually obtained, amply sufficient to occasion serious fires. And when a fire is once well under way, the gasoline tanks are destroyed, contributing their fuel.

With the higher price of gasoline, the use of kerosene is increasing for cleaning purposes, and in some cases for fuel. Especially for cleaning purposes kerosene is frequently urged as a comparatively safe substitute for gasoline. But it is interesting to note that there are seven instances where cleaning with kerosene or distillate is given as a contributory fire cause. The fires in the table "Gasoline and Oils as Contributory Fire Causes" also appear in the general table of causes listed under the primary cause, *e.g.,* under "static electricity," "lighting system," etc.

Carelessness.

In garages, as in every other class of property, carelessness is the real cause of almost all fires. Not being peculiar to garages, it needs no discussion here, except that a few conspicuous cases are worthy of mention. The sign displayed near the gasoline pump in the garage reading: "DON'T SMOKE HERE—EVEN IF YOU DON'T VALUE YOUR LIFE, REMEMBER THAT OUR GASOLINE COSTS MONEY," does not seem to have any great influence, for we have seen the owner of the garage smoking a cigar while filling an automobile tank within five feet of that very sign. Smoking is prevalent in garages in spite of all "No smoking" signs. Even where rules are enforced among employees, careless customers fail to heed warnings. Smoking in garage offices is often considered safe, but from one fire report the following is quoted: "Visitor, while in the office, lighted a cigar and threw the lighted match on cement floor where gasoline is spilled at times. The vapor ignited with a flash, fire spreading rapidly."

A few other fire reports are worth quoting:

"Employee threw pail of gasoline on hot ashes, mistaking the gasoline for water."

"Employee, after lighting cigarette, threw match into can of gasoline left on work bench."

Automobile and Garage Causes.

The special hazard causes in the table on the next page have been divided into those causes peculiar to the automobile and those due to garage operations. The garage causes are self-explanatory and in a majority of

GARAGE FIRE CAUSES.

	No. of Fires		Per cent of Known Causes
SPECIAL HAZARD CAUSES—			
AUTOMOBILE CAUSES:			
Backfire or Exhaust	126		27.5
Starting and Lighting System	29		6.3
Ignition System	16		3.5
Static Electricity during filling or drawing off gasoline	9		2.0
Engine Overheated	6		1.3
Filling—exact cause unknown	5		1.1
Carburetor—exact cause unknown	3		.7
Total Automobile Causes		194	42.3
GARAGE CAUSES:			
Oily Material	28		6.1
Vulcanizing	13		2.8
Gasoline Torch	8		1.7
Battery Charging	3		.7
Emery Wheel	2		.4
Burning Carbon from Cylinders	1		.2
Welding	1		.2
Kerosene Wash Tank	1		.2
Soldering	1		.2
Miscellaneous	17		3.7
Total Garage Causes		75	16.4
Total Special Hazard Causes		269	58.7
COMMON CAUSES:			
Smoking or Matches	61		13.3
Lighting	46		10.0
Heating	37		8.1
Power	11		2.4
Rubbish	8		1.7
Boiler or Fuel	7		1.5
Chimney or Stack	2		.4
Locomotive Sparks	2		.4
Lightning	2		.4
Total Common Causes		176	38.4
INCENDIARY		6	1.3
EXPOSURE		7	1.5
Total Known Causes		458	100.0
UNKNOWN		55	
Total No. Fires		513	

cases would not have been responsible for fires if the operations, such as vulcanizing, were carried on in properly cut-off rooms of fire-resistive construction.

Of the automobile causes "Backfire or exhaust" is the most important, being credited with 126 out of a total of 458 fires where the causes are known. The automobile engine depends for its power upon an explosion of gasoline vapor; it is not very surprising that the flame of that explosion sometimes escapes from the cylinder. Backfire and exhaust are two very different routes of escape of this flame, but they are classified together because it is felt that many fires reported as caused by backfire are probably actually caused by the exhaust. As originally reported, 121 of these 126 "backfire and exhaust" fires were called "backfire." The backfire of an internal combustion engine is a premature explosion forcing the flame back through the intake connections to the carburetor, where gasoline is always present. During improper gasoline mixture adjustment, flame and sparks may issue from the exhaust, but at this location there should be nothing combustible if conditions are as they should be.

The division of automobile electrical fire causes into "Starting and Lighting System" and "Ignition System" may be more or less arbitrary, but is intended to show that fires may originate from sparks and short circuits in the very low voltages ordinarily employed in the starting and lighting systems, as well as from the ignition system, which is especially designed to start fire, in its proper place, the cylinder. Almost twice as many fires are due to these starting and lighting circuits of only a few volts potential as to the ignition system proper. This is evidently because the ignition system is better protected, and is usually inoperative when the engine is not running.

Common Causes of Fire.

With the exception of "Smoking and Matches," which is conceded first place without further comment, lighting is responsible for the greatest number of garage fires. The table below gives lighting causes in detail. It is interesting to note that, in the absence of better illumination, matches are still being used to examine gasoline tanks.

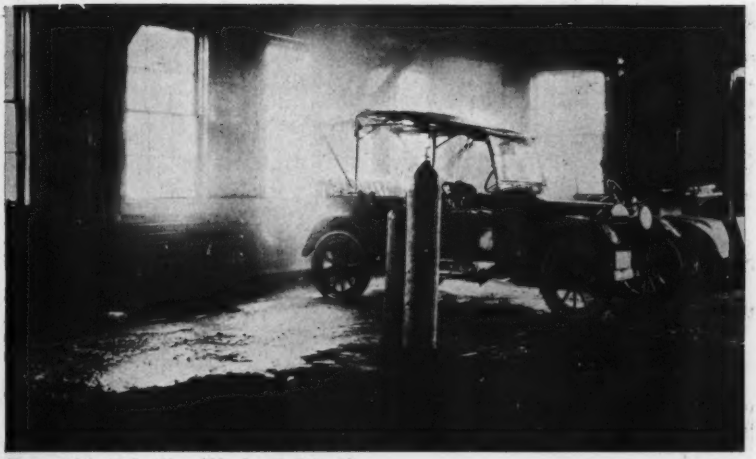
COMMON LIGHTING AS A CAUSE OF FIRE.

Defective Wiring	9
Short Circuit, extension light	5
defective insulation on extension wire	3
Miscellaneous	10
Broken Bulb Ignites Gasoline or Oil	7
Sparks from Portable Electric Lamp	2
Open Gas Light	3
Lighted Match to Examine Gas Tank	2
Lighted Match to Read Oil Gauge on Truck	1
Kerosene Lantern	1
Kerosene Lamp	1
Candle	1
No Data	1
Total	46

Photograph by Western Canada Fire Underwriters' Association (Member N. F. P. A.)

Fig. 1. In Calgary, Alberta, recently, a fire starting near this fire door burned for more than an hour before an alarm was turned in. A $200,000 stock on the other side of the door was untouched. The tin of the door was torn back by the firemen.

Heating is credited with thirty-seven fires. In twenty-eight of these the heating arrangements were manifestly unsuitable for garage use, principally because stoves and heaters were not properly isolated from gasoline and its vapor. For example, to quote from one fire report, "gasoline leaking through wood floor was ignited at heating boiler directly beneath."



Photograph by H. L. Miner (Member N. F. P. A.)

Fig. 2. Fire extinguished by one sprinkler head, which was still operating when this picture was taken. **(See page 138.)**

Construction Features.

Ventilation is perhaps the most important of all construction features. With adequate ventilation explosive gasoline vapors would not collect, and a large part of the fire hazard would be eliminated. For a discussion of garage ventilation see Member Charles E. Worthington's article, "The Common Sense of Garages," which appeared in the QUARTERLY last January (Q. V. 13, No. 3. p. 234).

Modern garage buildings are usually of concrete, and are therefore fire-resistive. But there is a tendency towards very large areas. Horizontal areas are usually as large as possible and are in no way obstructed by partitions, while in the city garage occupying several floors there is seldom any attempt made to protect vertical openings.

Although seldom used in garages, fire doors can give, and have given, excellent accounts of themselves in the journal of fire experience.

The accompanying photograph (Fig. 1) is a good example of what an automatic fire door can do in a garage. The building in which the picture is taken was used for tractor repairing. On the other side of the fire door is a $200,000 stock of builders' supplies in a frame building. The fire occurred on a Sunday morning, and had been burning over an hour before any alarm was turned in. The fire apparently started near the fire door, and the greatest heat was developed at this location. The material on the other side of the door was absolutely untouched.

Automatic Sprinklers.

Claims have sometimes been made that the garage hazard is too severe for ordinary automatic sprinkler protection, and that application of water is likely to spread the fire by floating burning gasoline. Records show no

Photograph by John Perry (Member N. F. P. A.)

Fig. 3. A recent unsprinklered garage fire in Yakima, Wash. Contrast this fire, where thirty machines were destroyed, with that shown in Fig. 2, where one sprinkler head confined the fire to the car where it originated.

basis for such opinion. In the N. F. P. A. files there are reports of 134 fires occurring in sprinklered garages. The accompanying table shows that of the 134 there were only four failures, making a total of 130 fires, or 97.1%, where the operation of the sprinklers was satisfactory. This compares favorably with a general average of 95.7% for all classes of occupancy. Of the four failures, two were due to water shut off sprinklers and two due to obstructions to distribution. A review of all the garage fire reports in the N. F. P. A. files has failed to disclose any instance in which burning gasoline was spread by water from sprinklers.

The accompanying photographs (Figs. 2 and 3) contrast the results of fire in sprinklered and unsprinklered garages. In the first case (Fig. 2), one sprinkler operated and extinguished and confined the fire to the car in which it started. Member H. L. Miner reports:

> Fire occurred in a one-story frame garage 50 x 100 feet in area, which contained twelve automobiles. Garage was locked up Saturday afternoon. Monday morning, when next visited, it was found that fire had occurred in one of the automobiles, cause unknown, possibly due to defective electrical system, or possibly from a smouldering fire due to smoking in the upholstery of the car. One automatic sprinkler to all appearances opened promptly and, although top of car was raised, thereby introducing considerable obstruction to distribution, the automatic sprinkler entirely extinguished the fire. Five feet from the automobile was a tank of compressed acetylene gas, also an oxygen tank. Photograph No. 2 shows position of car in garage and oxygen and acetylene tanks referred to above. The automatic sprinkler was still

EFFECT OF SPRINKLERS.

	No. of Fires.	
Extinguished Fire:		
Practically	48	
Entirely	29	
		77
Held in Check		8
Failure		4
None Opened (Insufficient Heat)		45
		134

operating when this photograph was taken. This is really a remarkable demonstration showing the effectiveness of automatic sprinkler protection, even though the sprinklers are working under a serious handicap.

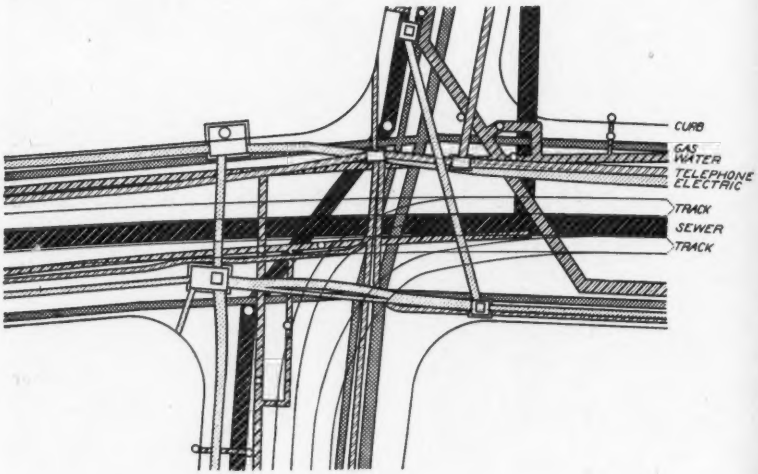
Figure 3 shows what recently happened in an unsprinklered garage in Yakima, Washington. Note that the building had brick walls—incombustible outside walls, to the ignorant, give the all too frequent impression that a building is "fireproof." Member John Perry reports that thirty machines were destroyed with an estimated loss on building and contents of $88,000, and considerable damage to adjoining buildings not included in this figure.

The table "Losses," showing a fairly large proportion of large losses in unsprinklered garage fires, while in sprinklered buildings, of the 134 fires on record there are no losses over $5,000, is another rather convincing argument for the sprinkler.

LOSSES.

	No. of Fires.	
Sprinklered:		
***Small**	134	
Large	0	
		134
Unsprinklered:		
Small	250	
Large	129	
		379
		513

*** Small loss is under $5,000.**



Underground Structures Laid Haphazard.

What happens when pipes and wires are placed underground without any control as to systematic location by the municipality concerned is shown by the accompanying illustration from the latest annual report of the Department of Engineering of Hartford, Conn. Mr. Roscoe N. Clark, city engineer, says in his report:

With but one exception, all the underground construction shown in this cut was installed prior to any attempt on the city's part to regulate or exercise any appreciable control over sub-surface work. The resultant random positions of structures in this intersection, and there are many others in the same condition, make it extremely difficult to assign locations for new work. If all these structures had been assigned locations according to present methods a great deal more space would be available for enlargements and for a probable high pressure water system for fire protection, or any other future installation.

It is safe to assume that every city in North America can duplicate these conditions with more or less fidelity in at least some of its street intersections.

Underwriters' Laboratories' Protection Department.

By W. C. Robinson,

Vice-President Underwriters' Laboratories and Vice-President N. F. P. A.

The work of the protection Department of Underwriters' Laboratories includes the investigation of devices, materials, methods and processes within or closely related to the fire retardant and fire extinguisher groups of the Laboratories' work.

In the following review I will omit many of the details and confine myself to the more interesting subjects, the newer developments now under way and the results that may reasonably be expected.

A complete line of fire retardants and fire extinguishers would include most of the items entering into building construction and equipment, the apparatus employed on the inside and outside for the protection of buildings against fire, and much of the equipment and some of the methods and processes employed to reduce the fire hazard incident to the occupancy of buildings. Our line is not yet complete but we are fast approaching the stage where our findings can be employed in the solution of any problem involved in preventing the spread of fire or in fire extinguishment.

It is difficult to establish in any very exact way the relative importance of the various subjects with which the department has to deal. We have reported upon a great many of the smaller devices and materials and have often felt that, in the grand aggregate, these may after all play a more important part in fire prevention than some of the more pretentious measures. At the same time, the necessity for the investigation of the larger subjects has never been lost sight of and our plans are constantly being extended to include such subjects as the larger items of building construction and the more elaborate extinguishing systems. Some idea of the magnitude of such developments may be gained by a study of the column test plant and its auxiliary equipment now in use at the Laboratories. We shall shortly have opportunity to study the results of the tests of over one hundred structural building columns, an investigation made jointly with the Mutual Companies and the Bureau of Standards.

The object of this investigation was to ascertain the ultimate fire resistance of loaded columns under conditions approximating those of actual service, to ascertain the relative fire resistance of various materials and methods now commonly employed for column protection, to ascertain the effect of the application of fire streams on such columns while in a highly heated condition, and to provide reliable data by means of which the fire resistance of the various columns can be compared so that the relative values of the different types and methods of fireproofing can be classified for use under conditions of actual service. We feel certain that the con-

clusions reached will fill a great gap in our understanding of the fire resistance of this most important part of building structures. Since the investigation work of this subject was completed, additional tests have been made in the interests of certain manufacturers to develop improvements in the fire resistance of the products in which they are most interested.

The fire resistance of floors is another highly important subject now receiving our active attention, and for these tests we have furnaces now under process of construction in the yard at the Laboratories. The performance of floors in actual fires has not been altogether what would be expected from the tests heretofore made, and our problem has been to provide the methods and apparatus that will closely approximate the conditions as we find them in buildings. The preparation of heavy restraining frames to resist, in a known degree, the lateral expansion of floors when subjected to fire, is one of the means to this end. At present we have three applications for the investigation of floors according to their fire resistance and we have no doubt but that this branch of our work will produce information of the greatest value.

Much more information covering the fire resistance of walls is available than is the case with columns and floors, particularly relating to walls of the more common forms of construction. There is, however, a great deal to be learned covering the fire resistance of concrete and tile walls and a number of walls of unusual construction. A fire wall coming within the latter category (or a wall made of Gunnite) is now under investigation. The test panels have been completed and will shortly undergo test. The conditions existing in the building industry bid fair to result in the development of other forms of wall construction that will require test and investigation before their fire resistance can be properly classified.

Although generally considered of lesser importance than the items heretofore mentioned, interior partitions and wall and ceiling finish probably constitute the items of building construction by means of which the most effective results can be accomplished in the reduction of fire losses, that is, reductions possible through changes in building design and construction. These items include the units with which the interior design of buildings may be so changed as to greatly restrict or confine the spread of fire within the building itself. The accurate classification of the fire resistance afforded by the materials and combinations as employed in these building members is most urgently required for use in the solution of fire protection problems at this time. The Laboratories have been at work on this subject for several years and quite a number of materials and combinations have been reported upon. These mostly apply to buildings of fire resistive construction.

Judging by our more recent applications, interest seems to be changing to forms suitable for buildings of frame and ordinary construction, and it is to this group that most of our attention is now being directed. It will be manifest that the establishment of the real fire resistance values of the forms of construction employed in the class of buildings that are by far the most numerous will enable us to better understand the causes of the great losses in such buildings and to provide the information that will lead to definite remedies.

The opportunities in this direction will be appreciated when I say that our investigations show that the fire resistance of wood lath and plaster finish of average construction is about five minutes after the fire has reached the stage where the contents of the building are thoroughly involved, and that the fire resistance of the substitute for lath and plaster most commonly employed is less than two minutes under the same conditions. This in addition to the fact that the latter finish also serves to rapidly convey fire to all parts of the building in which it is used. Including exterior wall finishes, our work on these building items has already included the investigation of some eight or ten types of construction differing widely in character and in the degree of fire protection furnished. On account of their employment in buildings of studded and joist construction, it has been necessary to include the study of the methods of fire stopping in hollow walls and ceilings. The accurate classification of the items already investigated in terms of period of fire resistance will probably be available during the coming year, possibly within the next few months. The gradual extension of such classifications to include various other forms of construction now on the market should afford means of accomplishing very marked results in fire prevention work.

Our work on roof coverings has continued as heretofore and, in addition, we have developed methods for the more accurate determination of the spark and flying brand hazard involved in the more flamable forms of roof coverings. Active investigations are now under way to reduce the fire hazards in wooden shingles. This work indicates the probability of a marked degree of success, particularly with certain forms of shingles.

Of the fire retardants that can be included under the heading "Building Equipment," portable safes occupy an important place in the work now before us. We have recently conducted tests on several old line safes and have received assurance of co-operation from this branch of the industry. The classifications already issued have resulted in a widespread interest on the part of the manufacturers generally, and it is perhaps not going too far to say that our work on this subject has stimulated very marked activities in the improvement of designs and construction methods known to be defective. Standard labeled safes of each of the three classes are now furnished by several manufacturers and there is a decided tendency to continue investigations in an effort to reach the highest development possible in a portable safe.

As illustrative of a classified fire retardant that has to do with the hazards incident to occupancy, I may mention a report rendered several years ago on a process for rendering baled cotton proof against flash and spark fires. This process has since been investigated by government and railroad officials as well as by many in the industry and now bids fair to be placed in general use. Incidental to the process, a noncombustible sheet metal cotton warehouse has been developed for housing the treated cotton and the further reduction of the fire hazard in this great commodity. Application has been made, and the investigation work on this structure is now in progress.

The work on devices classified as extinguishers has been particularly active during the past year. Generally speaking, our investigations of these devices have been along the usual lines with the addition of considerable

effort directed toward the improvement of the test apparatus and methods employed. In the work on automatic sprinklers the new developments worthy of special mention cover improved apparatus for determining the ratio of leverages and stress distribution between the parts, new apparatus and methods for determining the strength of the various parts of sprinklers, new apparatus for use in the accelerated corrosion tests employed, new apparatus and methods for ascertaining the operating temperatures of the sprinklers in the oven tests by means of thermo-couples instead of thermometers, and improved apparatus for determining the stress on the fusible element,—all to improve the accuracy of the methods employed in the determination of the reliability of devices of this character. In addition, a large number of sprinklers from equipments throughout the country have been received and tested to ascertain their reliability after various periods of service. During the past 18 months an average of 300 sprinklers of this character have been reported upon each month. A large number of inspection departments have given their hearty cooperation in this work which has now been reduced, to a large extent, to a routine.

The work on dry valves, alarm valves and auxiliary parts to automatic sprinkler systems has continued, and we are now in closer touch and agreement with the manufacturers in this industry than ever before.

Our work on outside equipment has been largely confined to the investigation and study of cast iron water pipe and fittings. This has been made necessary by an application for the approval of a special pipe made of iron that has been graded and refined in an electric furnace to increase its tensile strength, and an increasing interest on the part of other manufacturers in the action taken by the Laboratories on products of this character. It is unnecessary to call attention to the importance of water distribution systems in fire protection.

Study of the problems involved in the use of chemical extinguishers on wheels and in the development of the tests and investigation methods employed has been continued, with a view to establishing a closer relation between the machines submitted and the class of service to be rendered.

Many of the subjects handled by the department are intricate and no well defined precedents that can be used as a basis of our investigations are available. This has frequently made it necessary to spend a great deal of time and money in devising and perfecting the tests that will develop information suitable to our purpose, and the test apparatus that it is practical to obtain and employ in such work. Nearly all of the methods at present employed in the department have been so developed.

Information obtained in the development of the methods employed in the tests and investigations, our experience in the work and during conference, and negotiations with different manufacturers and users, supplies the data upon which the Laboratories' standards are based. A good many such standards have been completed and many more have been formulated and partly completed. This work involves a vast amount of careful study and research and is usually incidental to our regular work. Once established, the standards serve as a basis of future investigations and reports covering the subjects to which they relate. They can also be made to serve as a basis for the preparation of manuals for use by the engineers conducting the work. Such manuals will result in increased facility and

economy in the conduct of our work and serve as a basis from which cost estimates for new work can be accurately obtained.

Our findings must be correct and such that they are justified under the practical conditions in the field, such that they will appeal to the user as unquestionably the proper solution of his problems in fire protection; they must be obtained by methods that clearly show their relation to the practical conditions; they must be consistent when compared and used for the same purpose and uniformly applicable under like conditions. They should also be such that it is reasonably certain that they will prove to be permanent findings and not subject to frequent changes or modifications.

Our constant aim is to increase as rapidly as possible the practicability of our methods and the advices we promulgate so that they may be more readily utilized by underwriters, and also so that they will appeal to owners, architects, engineers and others as not only the correct findings but also a means to the most practical solution of the problems with which they have to contend in dealing with the fire hazard.

To accomplish this, it will continue to be our aim to present the results of our investigations in such form that all features connected with the use of the devices, materials and methods upon which we pass will be properly considered and related. In other words, we expect to improve the character of the advices we give to the end that all interested will find it not only practical but easy to properly utilize them.

A Little Discussion of Fire Walls.

By C. E. Worthington.

(Member N. F. P. A.)

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To begin: Just what is a "fire wall"? If you ask the question of a dozen persons chosen at random, you are likely to get as many different replies. All will probably agree in the general conception that a fire wall is a wall of some sort intended to block the progress of fire, but beyond that generality all is likely to be a confusion of ideas, hardly two agreeing even on major details.*

The underwriters schedules are based upon the conception of an ideal fire wall, starting with a thickness of 12 inches minimum in the upper story and increasing 4 inches for each additional story to the foundations. Such walls, however, are extremely rare. Apparently the controlling idea was to provide support by ledges for all joists and timbers instead of letting the ends into mortises, for in city buildings, as a rule, the wall intended to serve as a fire wall is also a bearing wall. To carry out this idea fully, however, would imply a parapet 8 inches thick, which would seem quite adequate.

The architect, in respect to these walls, is usually in a rather embarrassing situation. The cost limit is, as a rule, pretty closely defined in advance, and it is pretty well understood in a majority of cases that attractiveness of exterior design is the chief desideratum. Fire walls, however, are largely out of sight and if one can persuade his conscience that an 8-inch wall is safe there is no barrier to its use, provided no prohibitory legislation is in force. Occasionally, though very rarely, there is an architect to be found who does not have to persuade his conscience. Such dividing and bearing walls have been constructed in buildings 5 stories and more in height and upward of 100 feet in depth where the greatest thickness was 8 inches. It is probable that some such walls still exist. This construction has cost many lives.

Legislation of a really sound nature is very hard to obtain, any attempt at comprehensive specifications generally meeting with successful opposition, effective at least to the extent of securing modifications, for, at most, a building ordinance is frequently little more than a legalized "modus operandi" of architects and contractors—just stringent enough to keep the public quiet for the time being.

*A long controversy was settled by the adoption, at the 1920 annual N. F. P. A. meeting, of the following definition:

Fire Wall—The term "fire wall" indicates a wall subdividing a building to restrict the spread of fire.—ED.

Ordinances could, no doubt, be framed that would provide for real fire walls, but it is hardly probable that they could be enacted into law in many cities as long as present political conditions exist. Ordinarily the legal minimum is practically a maximum, excepting, of course, those instances where review is provided for by supervising officials with plenary powers.

In the usual city construction fire walls are almost invariably bearing walls, and stability is menaced by certain conditions. Joists and timbers mortised into the wall act as levers in event of collapse of framing, pressing out bricks and subjecting the wall to considerable strains. This would be entirely curable by legislation requiring self-releasing joists and timbers, but this adds to cost, and, like every other specific requirement, serves to limit competition to some extent; hence, there is and will be much pressure to prevent the passage of any such ordinance.

Mortar is disintegrated by heat—at least some kinds—weakening the wall by removing the support from the bricks, which become virtually loose. This also could be covered by legislation.

Expansion of the brick on the side toward the fire causes bulging and collapse in walls of insufficient thickness and too large unsupported areas. We may safely assume that practically every architect desires to construct a thoroughly safe building, and that at least a large majority are entirely capable of so doing if they could be given a free hand and released from destructive competition; but the architect must please his customers or cease to do business, and mere knowledge and disposition do not help much.

Buildings in general in business districts are intended to be income producers, and often—quite often—the very design that makes them attractive and easily rented embodies great fire hazard. Cost is also important, since the probable rental of a given space in a given locality may be closely computed in advance.

The conclusion seems plain, that the matter of fire walls as to dimensions, supports and the like should be governed by closely drawn ordinances in order that the requirements of safety may be made uniform and this much of construction taken out of the region of destructive competition.

Material and Conductivity.

We do not know as much as we probably will later as to the heat conductivity of different materials. Brick, we know, is a poor conductor, but it accumulates heat, which it gives off about as slowly as it accumulates it. The heating through of a brick wall of any reasonable dimensions depends entirely upon the intensity of the fire and its duration. It will eventually heat through if given time and the necessary temperature is maintained on one side. Intensity depends primarily upon occupancy and duration, and is largely a matter of construction; at this point the ordinary existing plan of classification fails completely. Classification of buildings by occupancy, toward which much progress is evident in the existing ordinances of New York City, appears to offer the best chance for remedial legislation.

It is clear that fires in certain stocks produce intense heat, sometimes of correspondingly brief duration; and fully as apparent that, while a

slow burning building, by virtue of its construction, retards fire in its earlier stages and offers better chances of extinguishment, when once well ignited by reason of the large volume of burnable structural material and its disposition the duration of the fire is greatly prolonged in that type.

In brick walls the bricks are not destroyed by fire but the structural integrity of the wall suffers.

Concrete has a much lower rate of heat conductivity than brick, and is more resilient. There is no mortar to calcine, and therefore little chance of bulging, since the expansion is also moderate. But the concrete wall is itself slowly destroyed by continued high heat; in one sense the concrete wall actually burns away over the entire exposed surface, but very slowly. Therefore, in general, less dimensions are required of concrete division walls than of brick.

Hollow tile and hollow concrete block have proved unsatisfactory for main fire divisions, and such makeshifts as nogged walls (brick laid 4 inches thick between studding, with or without mortar) may be dismissed without ceremony.

The popular idea is not fully in accord with this; walls of theoretically, or generally proven, insufficient character occasionally make phenomenal stops, and because these stops are unexpected they are likely to be well advertised. A single instance of this tendency to jump at conclusions will suffice: It happened in quite a severe fire in a large warehouse, which was almost entirely destroyed, that the progress of the fire to the unburned section was completely arrested by a partition of one thickness of 7/8-inch matched spruce boards, painted with cold water paint (fire retarding). The unusual character of this stop evoked considerable comment at the time. Some time later a request was made by insurance interests of a large corporation that they subdivide a very large area structure by building "standard" fire walls, whereupon the managing official in charge wrote to inquire whether single board partitions, painted with cold water paint, would be entirely satisfactory, adding that he had read something to the effect that they were entirely reliable fire stops.

Possibly a solution of this attitude may be found in the fact that the average business man is possessed of little technical knowledge and his judgment is much influenced by considerations of the moment; hence, when a request involving expenditure of money is received from any authority, public or otherwise, the first impulse is to seek that which will satisfy the request at the very lowest cost, the determination of minimum efficiency being left entirely to the particular authority making the request, with a feeling that whatever they will accept will be all right. Upon this prevalent trait was based the letter of the fire hose maker who, when asked for quotations, queried as to whether the hose was wanted for use in extinguishing fire or merely to satisfy the insurance companies.

Another thing that complicates matters to some extent is the local desire in certain cities of lateral extension of occupancies. In the majority of localities the tendency of an expanding business is the occupancy of a single building from foundation to roof, thus bringing every part of the structure under control of the management; but this is not universal, and a tendency does exist in some localities to expand on one level, cutting through as many division walls as required, so that a row of 5-story buildings originally well subdivided instead of having five tenants, each in a

separate structure, may have the same number of occupancies stratified, each occupying one floor of all the five structures. It will be readily conceded that, despite the progress in fire door construction, this not only weakens the wall resistance but also adds a number of contingent hazards.

A further, sometimes serious, obstacle to efficiency arises in a fortunately rather rare practice of erecting a building professedly for a specified occupancy and actually occupying it for the declared purpose for a brief period, then, after a still shorter period of vacancy, occupying for purposes which would have demanded heavier and more expensive construction had such proposed occupancy been originally declared. Provisions distinctly regulating this are seldom found in fire ordinances, and there are to be found everywhere thousands of converted structures entirely inadequate structurally for their occupancy and far below the legal requirements for constructing a new building to be used for precisely the same purpose. The fire hazard of all of this is almost indefinable in each separate instance, but is very clearly manifested in the aggregate.

Generally in new construction the weight of a dividing wall that will be safe under ordinarily expected extreme conditions is not difficult to ascertain, provided the architect can estimate such conditions or will sacrifice a certain pride of profession and seek some advice from those who can.

An unsupported (self-supporting) wall of any given thickness can be built up to a certain superficial area, but beyond that area it requires added support by buttresses or other means, a provision usually entirely neglected or overlooked, fire being a very remote contingency, especially a completely destructive fire.

The desideratum is, probably, such ordinances as would be very definite in specification upon all really essential points so as to entirely remove them from the effect of competition and a little wider spirit of co-operation between the fire protection people and the architects in general.

Fire Walls in Wooden Structures.

The utility of incombustible dividing walls at certain intervals has been long recognized, and the regulations of most European countries where there is much wooden construction provide for such walls at stated maximum intervals, a practice that never seems to have obtained to any great extent in America.

Here we have a condition of probable complete collapse both of framing and exterior structure, and a large part of the so-called fire walls in such buildings are defective because not completely self-supporting under fire conditions. That a wall is incombustible in itself does not cover the requirements, since completely independent stability is needed. Moreover, to be reasonably effective the wall must not only cut through the exterior finish, but must also in some manner be so designed as to prevent the "lap" of fire.

A method often resorted to is to extend the wall outwardly several feet (3 to 5 as conditions permit). This is impracticable where the structure abuts upon a street or narrow passage, and has several serious disadvantages where it is practicable. (Fig. 1.)

It extends the unsupported area of the walls, thus actually weakening the wall, the extent of such weakening, of course, depending upon the

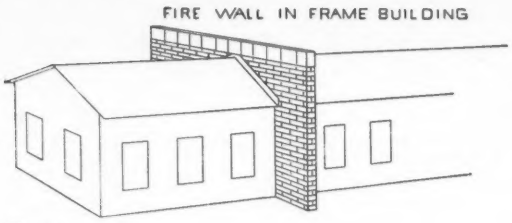


Fig. 1.

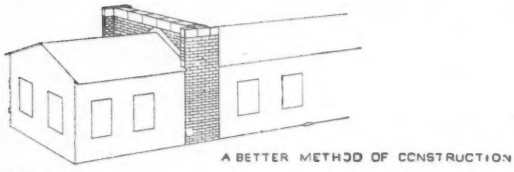


Fig. 2.

interior area; manifestly, however, conditions are easy to imagine where an extension of a few linear feet would carry well across the safety line. It also obstructs light, and unobstructed light is a modern factory necessity. It is less of a protection against "lap" than would superficially appear; this special phase will be taken up under a sub-division of the subject of parapets.

When applied to business buildings or dwellings the plan is too unsightly to be considered, and would involve so many other disadvantages as to remove it entirely from consideration, since sub-division in these classes is usually frontals (extending from front to rear).

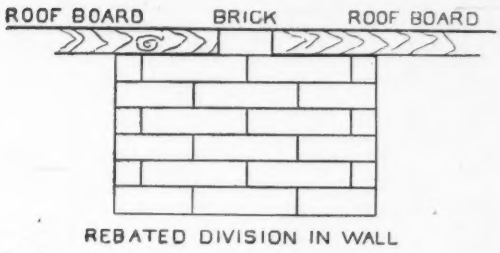
The only method of accomplishing fully the object sought is not only to cut through the outer wall, but also to replace 6 to 10 feet of the wall with brick or concrete at right angles to the fire wall and extending 3 to 5 feet on each side, and *of uniform height with the fire wall.* (Fig. 2.)

The advantages of this method are: It provides completely against the lap of fire, the general tendency of air currents being away from the structure after a certain distance is covered. It very materially strengthens the wall, permitting a considerably larger interior superficial area without buttresses or extra supports. It does not encroach upon surrounding space, and is never disfiguring or unsightly if properly constructed. It does not obstruct or interfere with light and air. It does not favor the creation of eddies which may carry fire directly against nearby windows, a remote but possible contingency with projecting walls. Its cost is little in excess of projection. All of these are material, if not vital, considerations, and are applicable to all classes of wooden structures.

(NOTE:—These walls may follow the contour of pitched roofs if desired.)

Parapets.

The progress of a fire in combustible exterior finish is wholly superficial, whether it be roofing or siding. It travels along the exposed surface, eating deeper later on, but the consumption of the body of the boards lags



REBATED DIVISION IN WALL

Fig. 3.

well behind. It is to arrest this that it is necessary to cut the finish, whether the sides or roof, perhaps more essentially of the roof.

Parapets, however, are the subject of unconquerable objection on the part of many architects and builders, unless the structure be tall enough to conceal them when viewed from the ground; hence, they are often denounced as a needless expense and as too unsightly for adoption, and are omitted wherever any sort of excuse can be found.

An examination of the building ordinances of many cities will develop an exemption from parapet requirements of low buildings (3 stories or less), the usual requirement for dividing walls (where such are called for) being that the wall *shall be carried up to the under surface of the roof boards.* This, to a certain extent, retards the progress of a completely internal fire, provided unequal settlements or wall shrinkage have not opened considerable gaps between roof boards and brick; but, as much of the supposed contact is under complete cover—often all of it—in roofs of light pitch, the existence of space between top of wall and roof is impossible to detect except by removing finish or breaking a way into a completely enclosed cockloft or roof space. As against the progress of external roof fires this method of itself affords absolutely no protection whatever, shifting all responsibility upon Providence and the fire department.

A compromise method is to forbid laying the roof boards across the wall, but permitting the ends or edges to rest in a rebate on the top of the wall and lie flush with the top of brickwork, with 4 inches or more of brick intervening between the boards on either side (preferably 8 inches). This, however, involves a slight addition to cost and, unless made a uniform requirement will be avoided, since even such slight differences determine awards in most cases. (Fig. 3.)

The existing method which provides for a completely concealed wall in lath and plaster construction once the finish is applied, affords great opportunities to "jerry" builders, since even the existence of a wall above the upper ceilings may not easily be definitely established. A method which permits only the roof covering or finish (not boards) to traverse the wall in contact with the brick largely avoids such possibilities, as the continuity and presence of the wall are completely ascertainable by percussion, a small hammer being the only required implement.

It is not at all probable that opposition to complete parapets in certain classes of buildings can be overcome at present, but this compromise,

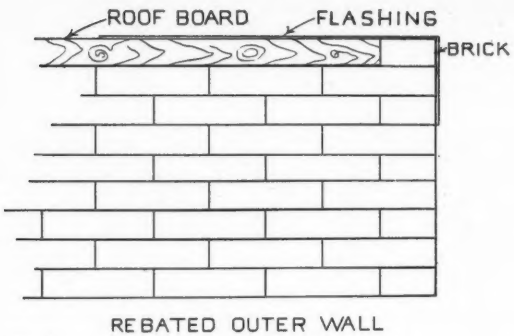


Fig. 4.

which yields very nearly the same results in low structures, might be largely obtained by pressing for parapet legislation. Difficulty arises in brick buildings with exterior drainage, a parapet on the drainage side even pierced at frequent intervals tending to accumulate snow and ice. The objection to parapets in such cases is a well-founded one, and well-nigh insuperable; in fact, a completely parapetted building is entirely practicable as a rule only when the roof is pitched to central interior drainage.

A rear or drainage wall treated as described, with the roof boards falling into a rebate providing 4 inches minimum of brick outside of the boards and the whole flashed back 2 feet under the covering instead of the ordinary 6 inches, forms a practical equivalent of a parapet under moderate or moderately severe exposures, and, in fact, such construction affords greater fire resistance than is given by the windows unless exceptionally well shuttered. For side (bearing) walls of buildings well above adjoining structures it is entirely effective and a completely tolerable compromise, since under such conditions the responsibility of parapet construction would fall upon the new construction should the height of the abutting buildings be increased. (Fig. 4.)

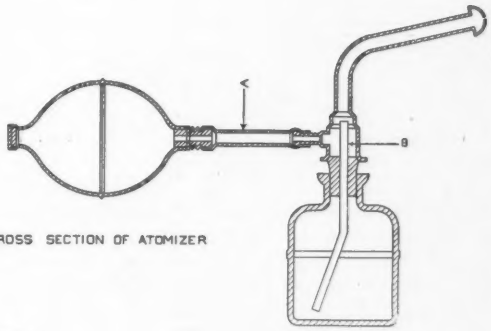
The proper height of a parapet is set by the National Board of Fire Underwriters at 3 feet above the roof, this being the height favored by many fire chiefs as affording protection to firemen without obstructing their work. It can be said without fear, however, that the effectiveness of a parapet is not dependent upon its height, and, even more, that it is entirely possible to ultimately increase the height to a point where the height, of itself, would introduce some new hazards; but just where the line of demarcation comes may not be stated offhand. Since the roof fire travels superficially, almost anything in the way of a break will suffice in roofs of reasonably efficient resistant covering, wooden shingles, of course, excepted.

When an interior fire breaks through and endangers the adjoining buildings a somewhat different condition arises, because of the large volume of fire and heated vapors and gases. Theoretically, the determination is somewhat akin in principle to determining the proper length of the barrel of a gun.

In general, with the wind blowing *toward* the fire across the wall or blowing parallel to the wall, parapets 12 inches high and even less have proven quite effective, so effective that we may for the moment disregard the 3-foot proposition and tentatively assume a minimum of 12 inches, or at most 18 inches, as effective, so that the main question is what happens to the adjoining roof when the wind blows across the wall and *from* the fire.

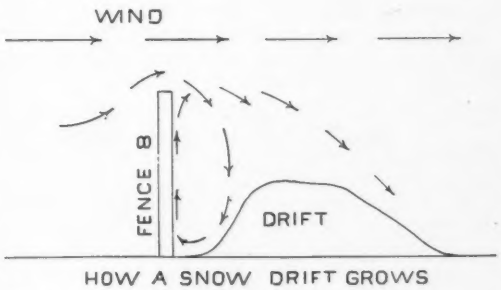
In considering this some principles of aërostatics may appropriately be cited and illustrated as of interest. We are taught that "a current of air blowing across an obstruction tends to a downward motion." Or, differently stated: Air moving rapidly across an obstacle sets up a partial vacuum behind the obstacles—a principle upon which the familiar atomizer and the vacuum brake are based. (Fig. 5.)

In the atomizer the air blows horizontally through Tube A across the open top of vertical Tube B, creates a sufficient vacuum in B to draw up the liquid in which its lower end is immersed, to be blown violently away by the air from A. In this case the air in both currents is under restraint. To be sure, the extent of the vacuum depends upon the velocity of the air from A, since the result is a frictional process, and, before the vacuum is set up, inertia and gravity must be overcome to induce any sort of vacuum.



CROSS SECTION OF ATOMIZER

Fig. 5.



HOW A SNOW DRIFT GROWS

Fig. 6.

Before there is time to ask what connection there is between an atomizer and a parapet let us go one step further. We are all more or less familiar with board fences, and those who live north of the Mason and Dixon line generally have some personal knowledge of snowdrifts. We all know that the apex of the drift is some distance away from the fence when deposited by a wind blowing *across* the fence, and that a space almost or quite free from snow lies close to the obstacle, and we generally

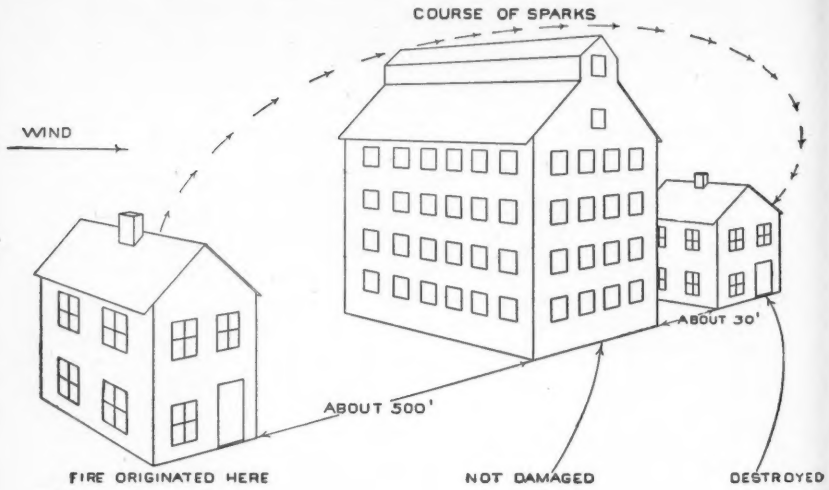


Fig. 7.

know that the height of drift, distances, and the comparatively clear space are dependent on the velocity of the wind, all being more marked in severe storms, but not appearing at all in a gentle snow fall.

Both air currents and wind are changeless in their nature and manifestations. Sparks, vapors and flame carried by the wind are carried exactly as snow flakes are carried, except so far as the specific gravity of what is carried affects the result. So far as ordinary sparks and small embers go, it is almost exactly as though they were snowflakes, the difference in action being unappreciable.

Suppose we begin with the snow drift. We will try to make a sort of diagram showing a fence and a drift as ordinarily seen in a high wind and the direction of the air currents by means of arrows (not very perfectly, but roughly approximate). (Fig. 6.)

It will be seen by reference to the cut that the air blowing against the fence is somewhat compressed and forced upward until the top of the obstacle is cleared, when it is carried across. When it goes across two things happen, viz., whatever compression existed at the point of clearing the fence is equalized by a corresponding expansion which forces some of the air downward. And the rapid motion of the air escaping restraint as it clears the fence sets up a partial vacuum, just as in the atomizer, except that it is under less restraint.

Now the vacuum induces an upward motion of the air next the fence, and this vacuum must be supplied. The result is the ultimate diversion of a part of the blown over air into an eddy or cyclone, or whatever you wish to call it, with its "active" point next to the fence and a "dead" space outside the circumference where the opposing forces are neutralized. This is exactly what may, and probably often does, happen behind the parapet, except that the specific gravity modification mentioned has a tendency to

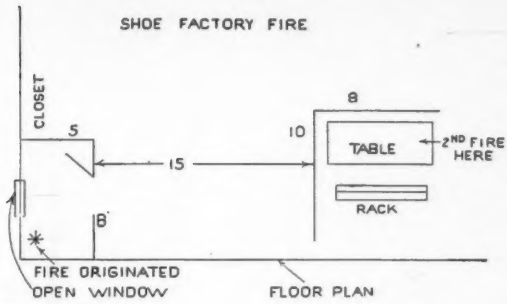


Fig. 8a—Plan.

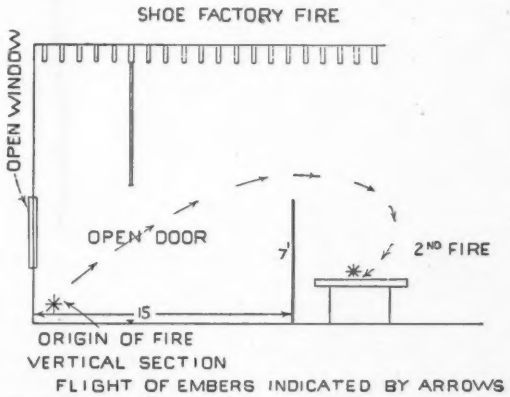


Fig. 8b - Elevation.

enlarge the diameter of the eddy, and will completely explain many of the so-called "freaks" of fire.

A very interesting demonstration of this was given in court by the Hon. Butler Ames of Massachusetts as an expert in a suit against a railway company for alleged firing of a building by locomotive sparks. The wind at the time of the alleged firing was directly across, blowing from the burned building toward the railroad, and of moderate force. Mr. Ames, by means of a cleverly constructed pasteboard and wood model of building, track and locomotive and an electric fan, demonstrated fully that when a fairly strong movement of air was set up across and from the building the sparks and smoke from the locomotives blew *toward* the building.

A further interesting example is shown in Fig. 7. The two smaller structures were shingle roof frames; the taller had a spark resisting roof, and it happened that the second building was within the "dead" space.

The illustration is not drawn to scale, but merely in reasonable proportion, as can be seen by mentally substituting fence and snow drift in former cut for high and right hand low structure.

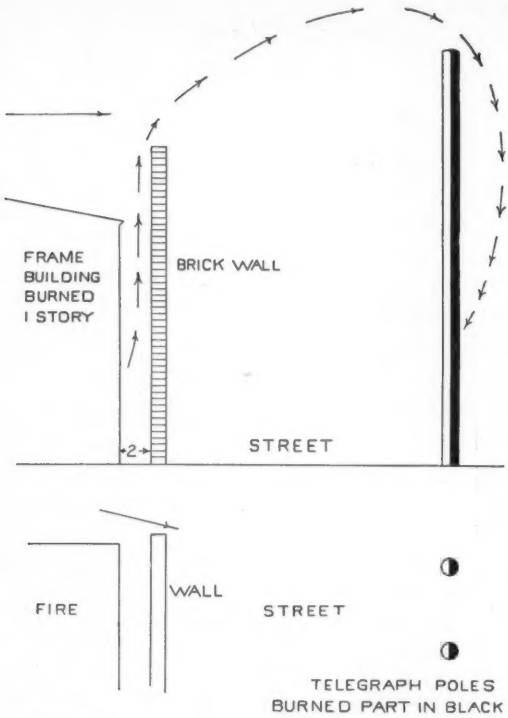


Fig. 9.

Perhaps this may be clearer from the diagram of an interior fire. This fire was completely controlled by the automatic sprinklers. When those who responded to the alarm arrived they found two fires burning in separate places in the large shoe factory work room. (Figs. 8*a*, 8*b*.)

The fire originated in a water closet, with open window and door, just after closing time. Directly in front of door of closet, and maybe 15 feet distant, was a partition about 7 feet in height, behind which were a table and rack with freshly cemented stock, and on the further side of the room a partly open window. Very light debris from burning paper, etc., was carried entirely across the shop, but the heavier pieces, large enough to communicate fire, were carried over and back and dropped upon the table.

The fact of two separate fires produced some temporary suspicion of incendiarism, but that was proven practically impossible. The bearing of all of this upon the proper height of a parapet will be self-evident. There is a point where the vertical height, while affording protection, is not enough to create a sufficient vacuum to set up a strong eddy, and to extend the wall above that point is an error. An instance curiously illustrated is shown in Fig. 9.

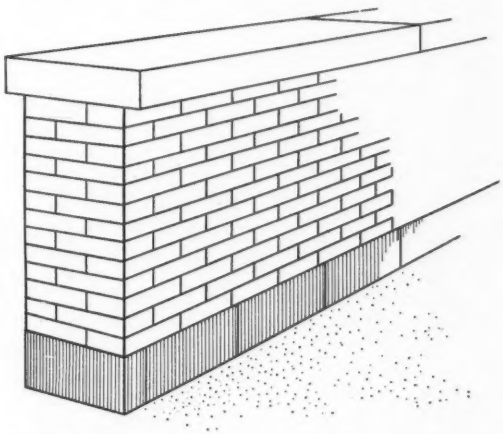


Fig. 10.

The burned building was in course of reconstruction, the method adopted being the erection of brick walls just far enough outside of the wooden ones to permit of working with the intent of roofing over and demolishing the original structure under cover. At the time of the fire the wind blew strongly in the direction shown by the arrow, and there was probably a strong upward current in the space between the building and the new wall, as well as vacuum beyond the wall. The combined effect of these was to carry the highly heated vapors in a sweeping eddy against the further side of the telegraph poles on the opposite side of the street, that side being deeply charred, while the side toward the fire was unmarked. This was not a "freak," but a logical result of conditions and forces as they existed at the time and place, and as such is of some practical value.

There is no reasonable ground for disputing 3 feet as the most effective height of a parapet, nor, on the contrary, any sufficient reason for confirming it, except that there is some room for suspicion that it may possibly be needlessly high, since *within certain limits* the lap or eddy would increase with the height of the wall, and the adverse effect that every increase in superficial area exerts on stability.

It is also fair to suggest that on all sides but one a much lower wall than 36 inches is effective, probably 18 inches, and this would cover seven of the eight points of the compass; but, since the most exposed side leeward cannot be predetermined, the proper height of parapet on that side must govern all.

As applied to the suggestion of fire walls of increased height to protect monitors, roof houses and the like when (as is usually the case) the monitor presents an end to the exposure it would seem better to require

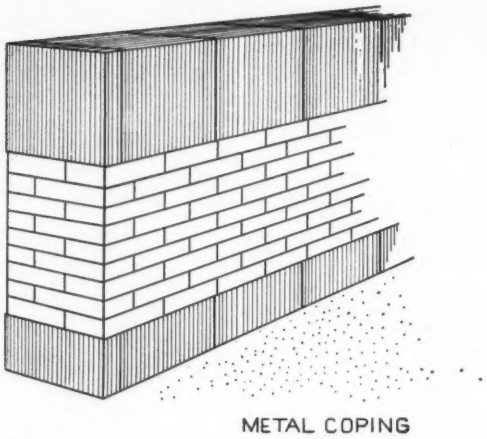


Fig. 11.

the exposed end of the monitor to be completely fire resistant, rather than increase the height of the parapet. Roof houses of all descriptions, however, can be built completely resistant at so small a cost that the expediency of any other method is doubtful, if a citizen desires to be careful.

Thickness of Parapets.

Though theoretically every foot of increase in height is a step toward instability, the superficial area of a parapet wall, even if 3 feet high and of any ordinary length, would not seem to warrant any expectation of distortion by heat, even if but 8 inches thick, nor are there conditions of contact with combustible material on the opposite side to consider, even if the heat at any point above the roof would sufficiently heat such a wall through within the period of its continuance. It would be interesting, however, to know why the thickness of parapets is arbitrarily placed at 12 inches, since when such parapets are above a 12-inch wall the timbers or boards of roof must either be carried on corbels, which are costly and unlikely to be adopted, or on timbers spiked or bolted to fire wall, or, in default of this, mortised into wall.

Coping.

Coping is designed to protect the horizontal top of wall from weather disintegration; the vertical faces are no more exposed to this than the walls of the building itself or any other face of a vertical brick wall. This requirement is often interpreted as a demand that the coping and the flashing at the roof be continuous, but this from a fire standpoint is needless, and, as a matter of protection from leaks, of little practical value. Terra cotta coping which drops 4 inches to 6 inches over top is quite as effective as metal, as is also projecting stone coping. (Figs. 10 and 11.)

Openings Through Wall.

All openings through wall are to be deprecated as at least weakening fire resistance; where needful, automatic fire doors of the best quality should be used on both sides of wall.

Fire Partitions.

For the sake of a clear understanding it is suggested that, for all divisions not standard fire walls, the term fire partition be used. Separating walls of plank, plain or metal covered, tile, concrete block and the like would come under this definite head.

Fire Walls Essential.

The parapetted fire wall is an essential feature of the best construction and should receive at least as much, if not more, consideration than any other single feature, for, although the contingency may be remote, the safety of the entire building and its contents may at any time rest entirely upon the performance of this wall, as also may the prevention of a district from conflagration originating in a fire on these premises.

It is as essential to fire resistive construction as to any other, and in any case should be proportioned to meet all conditions which may eventuate. And the main feature besides resistance is that it must be *complete*, so complete that under no reasonably expected condition can a fire get through it, over it or around the ends. It is with the object of aiding in the final definition of what constitutes such a wall and the promotion of such construction that all discussion should be entered into.

There is, however, an obvious exception as regards parapets (not fire walls) in buildings of resistive construction where such construction is extended to roof and all structures above the roof.

Telephone Fire Alarms.

By F. A. Raymond.

(Member N. F. P. A.)

For convenience and speed in handling fire alarms and ordinary business, there should be, in any fire department having more than five fire stations, a fire alarm telephone desk or "Private Branch Exchange" connected by two or more trunk lines to the Public Exchange, with a fire department operator on duty.

Between the Public Exchange and the fire alarm telephone desk (P. B. X.), there should be one or more trunk circuits for fire calls only; some busy fire alarm offices have two or three trunks from the nearest public exchange reserved; some have one trunk from each of the public exchanges in the city, connected right through the nearest public exchange, so that the district exchange operator need not wait for a trunk line connection, but can plug right in to the fire alarm desk. In some cities these reserved trunks are one-way lines; that is, there are no lamps at the public exchange end, so that the fire alarm operator cannot call over them by mistake. The switchboard jacks of these trunks should be painted red, both at the public exchange and fire alarm desk, so that operators will know instantly and always that these are the fire call lines.

For an automatic phone system, it may not be expedient to use a different call number for "Fire" than for "Fire Department"; in this case there should be sufficient extra trunks from the nearest public exchange to the fire alarm desk, so that the automatic selector switches will always have one free to pick up, and the fire alarm telephone desk should be operated manually so that one trunk can be always held open for a fire call.

In a manual exchange the person calling must first talk with the local exchange operator, who should ask at every call for "Fire Department," "Is it a fire?" If "Yes," she should plug in on the red fire jack and call the attention of the chief operator; until the fire call is disposed of she should take up no additional calls. If the party calling says "Fire" or gives the phone number set aside for fire, the operator will plug in on the red jack without further question, calling the chief operator as before. The chief operator should get the phone number of the party calling if possible, and note it, with the time, to be prepared to assist the fire department operator in locating the call, if calling person is too excited or otherwise not readily understandable; this will also be valuable in case of a malicious false alarm. If the person calling says "No fire" or otherwise indicates other business, the exchange operator will connect him to a trunk not reserved for fire. In no case should a "Fire" trunk be used knowingly for other purposes.

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In a department with five or less fire stations, the National Board of Fire Underwriters' Schedule does not call for a fire alarm telephone desk (P. B. X.); in a department of this size there will not be enough telephone business usually to warrant the expense.

In a department with more than five stations a P. B. X. is required, as there will be sufficient telephoning to warrant this convenience. In either case, there should be means for calling companies simultaneously or in groups; these groups would usually be by battalions. This is not merely for transmitting telephone alarms, but is largely for convenience in handling routine messages, to reduce the load on the department telegraph circuits. In a city with ten or less stations it will generally be feasible to call all stations, by a bridging jack at the P. B. X., or by a ringing circuit, operated by battery or magneto at headquarters. Sometimes two or three strokes are sent out by Morse key over the gong or tapper circuit, which calls all house watchmen to the phone. Any effective method of calling someone at every fire station simultaneously to the department telephones will be considered as a satisfactory call. Where there are more than ten fire stations, it may be advisable to call only a part of the department at a telephone alarm; this can be easily arranged by proper switches at the telephone desk. It may be best to call only the nearest company by phone; notification to the department generally must be over the telegraph circuit, usually by break-wheel transmitter, or some other form of code transmitter.

This will also be used for confirming notice, if the general call is by telephone. After one or more of the companies have been notified by phone, the nearest street box number is sent by break-wheel. In many cities "imaginary" or "dummy" numbers are assigned to street corners where no boxes are placed, and are used for telephone or verbal alarms. The chief objection offered to this has been a supposed tendency to cut down on the necessary additions to the real boxes; this effect has not appeared in practice, however.

Some fire alarm offices have gone so far as mark every address in the telephone or city directory with the nearest street box number; others have marked each block of the street directory with the nearest box number; the directory is hung convenient to the fire alarm telephone operator. Often a wall map is used, with the box locations and numbers marked conspicuously and the street numbers at each street intersection.

The fire alarm telephone desk will not always be in fire headquarters. It must be where some municipally-controlled employee is always on duty. This will often be at police headquarters; in the average small city the fire and police telephone desk may be combined with advantage. In cities under 10,000 population it may often happen that a combination of part or all volunteer fire department and few policemen will make it necessary to depend upon the local telephone exchange, especially for night duty. It is in just such exchanges the service is liable to fail or be delayed; often there is only one operator on duty, or two at most; she will be asleep or dozing when called and it is slow work to get fire headquarters late at night. With an automatic system, calls are made through to the fire station or fire chief's house and no trouble arises from a sleepy operator.

Wherever there is any paid force, they should get the telephone alarms at night, whether they sleep at fire stations or at home. If they are to be called by the public exchange operator, proper bridging switches (jacks) should be arranged so that she may call them quickly. In some places the janitor or night man, or engineer who sleeps at the fire house, has an extension phone in his bedroom; the exchange operator can call all these simultaneously and repeats the location of the fire several times until all have received it; then she may ring each one separately and on getting no answer (or an answer from the family if watchman lives in quarters) may assume the apparatus has answered.

For oral alarms (miscalled verbals or stills) the company notified will respond, but should first notify headquarters; if the case is urgent, better leave a man behind to call up, so the department will know the location of the fire. If the headquarters company happens to be the one called, the alarm may be sent out to other stations as a telephone alarm. Of course if it is a grass fire, shed or dump, etc., it will often be unnecessary to send more companies, but there may be a second fire in that district and the department should be informed so as to cover in.

A method used in some places is to place a fire alarm box on or in the station and pull this if company goes out on an oral call; the box should be outside the station rather than in, for if a citizen comes up while the company is out, with a call for a second fire, he can pull the outside box and get help as from any street box.

Objection has been made to the National Board recommendation that the "same response be made to telephone alarms as to box alarms in the same district." It is urged that since the call is to a definite building, it is unnecessary to call the large amount of apparatus that answers to a street box, and additional apparatus can be called quickly if needed; if the fire is serious it will be seen from the street and a street box pulled. The obvious answer is that this leaves purely to chance what response the department shall make; that is, whether alarms come by box or phone. The probability is that the usual response to first box alarms is too great in some districts. The National Board of Fire Underwriters considers that the first alarm response in any district should include two engine or hose companies, and where long ladders may be needed, a ladder truck. The reasons for two companies are: there may be delays or breakdowns to hold one, often a company will be shorthanded or must do rescue work and there may be no one to handle hose or tools. In a fully motorized and properly manned department, the writer feels that two engines or hose companies and a ladder company are sufficient for first alarms, except in a mercantile or manufacturing district or for some special hazard where a rapidly spreading fire may be expected, such as a cotton or tobacco shed, a shipyard, oil storage, grain elevator, etc. To a mercantile district, three or four engine companies should respond, depending upon hazards, location of second alarm companies and street obstacles; always one ladder truck and sometimes two should be included. It is doubtful if more than four engine companies are needed at any first alarm, except for certain special hazards. Also it is possible that the first alarm response may safely be less in the day time than at night, since a night alarm is more likely to be delayed, and there are less fires at night, consequently less chance of a second fire calling the same companies before they return

from the first fire. We have seen in some cities, notably with large volunteer departments, a response of five, six, or seven engine companies on first alarm; the only evident effects are heavy water losses, confusion and ineffective control of fires.

Telephone vs. Telegraph Alarms.

In connection with the foregoing discussion of methods of handling telephone fire alarms, there arise the question whether and why the telegraph is to be preferred for the transmission of fire alarms in all cases, and the best methods to be adopted, if any are needed, to increase the proportion of telegraph alarms.

Fire alarm telegraph circuits are normally closed and under constant test; any trouble liable to cause loss of alarms can be made to give a trouble signal automatically, so that repairs can be effected; telephone circuits are normally open and therefore not under constant test. Fire alarm telegraph circuits are under the control and care of the municipal authorities; they are, or at least should be, better constructed and maintained than is practical in commercial systems, such as the public telephones. The expense of maintaining telephone circuits generally, in the same excellent condition as is required for municipal telegraph systems, would be prohibitive. On the other hand, to get the same high degree of protection from the telegraph system alone that we do get from the telegraph and telephone combined would also be prohibitive and probably impossible.

It appears obvious that each class of service has its proper place and neither should be neglected. We have made it plain in the foregoing discussion that much of the trouble heretofore experienced with telephone alarms has not been inherent in the telephone service itself, but has been due to faulty methods and lack of appliances in the fire department for proper handling of telephone alarms.

Hence, we should consider how we may best use both services for the ready receipt and transmission of fire alarms, instead of neglecting or misusing either service because it may have certain inherent defects from an ideal viewpoint.

No doubt much of the prejudice frequently noted in fire department circles against the telephone is due to the fact that the common use of the telephone is a comparatively recent development, while the fire alarm telegraph is one of the earliest uses of electricity for purposes of communications and the art is more thoroughly developed and fixed; the telephone is regarded perhaps somewhat as an interloper.

The telephone alarm has these advantages: when all goes well, such alarms call the fire department to the exact location of the fire and give definite information as to its character and extent, so that an adequate force may be sent out at once to control the fire; it eliminates such absurdities as 4 engines, 2 ladder trucks and a water tower hurrying to extinguish a fire in a rubbish heap; in nearly all cases of fires in residences, small stores and workshops, and offices, it is quicker and more convenient than the telegraph, especially where automatic telephones are installed. Many cities depend entirely on telephones for sending in alarms; in many other cities the residential sections are protected mainly or wholly by telephones.

The telephone also has disadvantages; since it is a commercial proposition there is greater likelihood of interruptions occurring, and lasting for longer periods than could be permitted in a municipal fire alarm telegraph system; the dangers of strikes putting the system entirely out of service; the indifference and dilatory actions of operators, so increasingly evident in recent months; the occasional confusion of sounds over the telephone, as 7 for 11, Pine for Vine or Nine, Second for Seventh, 59 for 69, etc. (These things have occurred, but possibly no oftener than telegraph indicators have missed a stroke or "hung up.") In cities with a polyglot population, it is quite impossible for the fire department operators to understand all the frenzied language shouted at them over the phone; Yiddish, Syriac, Slovak, Polish, and what not; here indeed the telegraph box has a decided advantage. Some of the disadvantages urged in firemanic circles against the telephone are difficulties deliberately constructed by the fire department itself in the endeavor to discourage the use of the telephone for fire alarms; a reduced response to telephone alarm is the usual thing, and has been carried to such lengths in some cases that only a wagon with 2 men, or even a man on foot, with an axe and extinguisher, has been sent to a telephone alarm.

These same fire department officials who urge the reduced response to a telephone alarm as a disadvantage will not hesitate to assign a reduced response to a special box, located in a building with severe hazards, such as a theatre or clothing factory, on the theory that since the special box gives the exact location and somebody is evidently there to direct the firemen, it will be quite easy when the first companies arrive to pull the nearest street box and get additional help. So also, if a citizen enters a fire station and gives an oral alarm, in some departments only the one company responds, without even notifying the rest of the department; while if the same citizen had pulled the box on the front of the station, 3 or 4 companies would respond. Some fire chiefs manifest the absurdity of their arguments against the use of the telephone further by using the public phones, or portable phones jacked into the telegraph circuits at a fire alarm box, to send second alarms or special calls for additional companies, for serious fires.

The telegraph has the greatest advantage that all signals are or can be properly recorded. In the past this record has often been made only by numerical indicators with their numerous defects and failures, but paper tape registers have now largely taken the place of these. This change has also permitted the speeding up of alarms, since the tape register can operate much faster than the numerical indicators.

The modern fire alarm telegraph box is reasonably fool-proof, weather-proof, durable and reliable. It may be used by anybody with sense enough to pull a hook, and sends the same signal for all, regardless of the language spoken by the person pulling it. It is accessible at night and Sunday, when telephones are liable to be not readily accessible in a mercantile district; any passerby or patrolman observing a fire may send an alarm. It is the standard method of sending an alarm and all other methods must be adjudged by comparison with it.

The cost of standard boxes and their installation has been a deterrent feature in securing adequate protection by fire alarm telegraph; with the great increase in recent years of telephone distribution the telephone has largely superseded the telegraph box for sending in alarms.

However, the telegraph circuits are normally closed and under constant electrical supervision; the conductors are heavier than telephone lines and usually well separated from other circuits and less subject to derangement or breaks.

When underground, if in telephone cables, the lines are no more liable to trouble than the telephone circuits; if properly installed in separate cables, they are less liable to trouble.

The central office apparatus as now constructed is the result of many years' experience and, like the boxes, is reasonably reliable, durable and fool-proof. When properly installed in a fireproof building and properly cared for, there are few intricate mechanisms more generally satisfactory. Unfortunately many central offices are not in satisfactory buildings, nor well installed, nor properly cared for. The standard of housing and maintenance in the telephone exchanges, at least those of the Bell system, is generally higher, although the modern fire alarm offices, constructed after consultation with experienced engineers and architects, generally compare favorably.

It is the concensus of opinion that telegraph alarms are handled quicker, more reliably and with less confusion at fire alarm headquarters and at fire stations than telephone alarms. Especially is this true in an automatic fire telegraph system, where no human intervention is required at the central office. This being the case, it is desirable to foster the sending of alarms by telegraph rather than by telephone. How may this be done?

Probably the experience of Newark, N. J., is as good as any the writer is familiar with. This city has a fairly adequate fire alarm telegraph system, with boxes well distributed in the mercantile and manufacturing districts, including many private boxes; in residential sections, box distribution is from fair to poor. Boxes, iron posts and a band around the wooden poles are painted red; there are no red lights. About 1903, the telephone alarms had increased to such an extent, over half of all, that the department began active measures to increase the proportion of box alarms. Keys were placed in lock in all boxes, without glass guards; at first there was an increase in the false alarms, but this soon decreased, as the city became familiar with the system. Then owners of large buildings or places of special hazard were encouraged to install private boxes; in 1913, these were 37 per cent. of all the boxes in the city. Then placards were distributed to all mercantile and manufacturing buildings, schools, and other places of assembly; these were printed in red, with a picture of the box front with the number and an inscription like this: "The nearest fire alarm box to this building is 532, corner of Smith and Jones Streets. In case of fire, open the door and pull the hook."

These measures brought the proportion of box alarms up to 80 per cent. by 1907, after which it dropped slowly, due to the growth of the city and increase of telephone service, with poor box distribution in residential districts; in recent years, box alarms have averaged around 70 per cent. of all. The remaining 30 per cent. includes telephones, sprinkler supervision, night watch and orals. No doubt with adequate box distribution and red lights, the proportion of box alarms could be further increased.

In Manhattan, where the telephone alarms have been always discour-

aged by the fire department, although the box distribution is inadequate, 65 per cent. of all alarms were from boxes and 25 per cent. from telephones in 1912.

It is evident that there will be an irreducible proportion of telephone alarms, which will tend to increase with the rapid growth of our cities.

Another feature disclosed by the fire department records is that in general, the percentage of false alarms from boxes is two to three times as great as from telephones. The records on this point are incomplete, but in nearly every case where details are available, the false box alarms are in greater proportion than the false telephone alarms. Yet, the supposed opportunity for false telephone alarms is one of the arguments frequently brought against the use of the telephone.

We should recognize, therefore, that both telegraph and telephone have their proper field in fire alarm service. Our efforts should be directed toward securing proper adequacy and reliability of the fire alarm system, and adequate means and prompt methods of transmitting the telephone alarms; from mercantile and manufacturing districts, the telephone alarms may be largely eliminated by adequate distribution, quick accessibility and conspicuousness of fire alarm boxes.

The Sprinklered Property as a Conflagration Barrier—A Historical Review.

By C. L. Scofield.

(Member N. F. P. A.)

At the outset, one is confronted with the query—What is a conflagration? The dictionary term is "a large and destructive fire." The late Mr. Albert Blauvelt in his paper "Debarment of the City Conflagration" in the July, 1914, QUARTERLY, called it "A fire so hot as to keep firemen at a distance," and "that the horizontal reach of a heavy fire driven by wind ranges from a few hundred to more than a thousand feet, whereas the most powerful hose streams are not effective at over 200 feet."

Definitions of Conflagration.

A recent conference between special committees of the National Convention of Insurance Commissioners and the National Board of Fire Underwriters adopted, for statistical purposes, the definition framed by the Actuarial Bureau Committee of the National Board, that "A conflagration may be regarded as any casualty which produces a loss of a million dollars or more." This may involve only a single property. A conflagration has been otherwise classed as a fire burning two or more buildings, without respect to value, which in small communities especially, might mean a monetary loss only slightly approaching a million dollars. The New York Journal of Commerce and Commercial Bulletin in its compilation of fire losses has heretofore taken the minimum of $500,000 as a conflagration. Consideration in one of our annual meetings, if our late Committee on Nomenclature could be temporarily resurrected to submit in its former able manner a proposed definition, would likely evoke as much discussion as that on the fire wall. However, for the purpose of this article, conflagrations will be those recorded catastrophies in the larger municipalities which have involved the destruction by fire of a number of buildings with a heavy monetary loss.

Favorable Showing for Sprinklered Properties.

It cannot be expected that a few scattered sprinklered properties in a large city, and with unprotected window openings, will withstand a conflagration if directly in its path. Nevertheless a perusal of the records available show that the sprinklered property has aided in stopping conflagrations well under way, and has been destroyed more slowly than unsprinklered property, even with an inadequate water supply.

"Absorption" Theory.

The theory was advanced in Mr. Blauvelt's paper quoted above, that several rows deep of sprinklered buildings, even with unprotected window openings, will stop a conflagration by absorbing the heat in the spray from the sprinklers, assuming, of course, sufficient water to supply them. There are well established instances where a sprinklered building exposed by an unequipped one suffering a bad fire, has prevented a conflagration, although in some cases at a heavy sacrifice to the protected building.

Double Virtue of Sprinklered Properties.

As a conflagration barrier, the sprinklered property may be said to possess a double virtue. With a standard equipment in the average building, it eliminates the possibility of a fire gaining any headway in the individual premises and it also prevents or retards the spread of a fire originating in exposures, the result depending on local conditions. Many a "conflagration breeder" has ceased to be a menace to its neighborhood by the introduction of a standard sprinkler equipment. It therefore follows that the greater the number of sprinklered properties in a municipality, especially in what are designated as the congested districts, and the closer their grouping, the less likelihood of a conflagration. The apprehension felt in New York City in the severe winter of 1917-18, when the unusual conditions impaired many sprinkler equipments, will be recalled as an instance of the security felt with such systems in a large city, and the same applies to Montreal during the strike of the waterworks employees in January, 1920.

Summary.

A historical review of the behavior of sprinklered properties in a number of conflagrations may be of interest. While local conditions have naturally influenced results and no conclusion may be deducted as a positive guide for the future, two striking features present themselves. One is not a sprinkler proposition, but the value of window protection, and the other is that main reliance for the effective use of sprinkler equipments in such exigencies must be in the municipal water supply. There are admittedly exceptions, and while a standard secondary water supply is needed for the individual property to ensure reliable protection during interruption to the municipal pressure or to supplement it; yet in the average sprinklered property the additional supply must necessarily be limited in capacity and will not serve long in a conflagration. This shows the need of municipal systems of ample water supply and pressure, and is likewise advanced as an argument for connecting high pressure systems, wherever available, to automatic sprinkler equipments.

In the detailed list appended, the authorities for the statements made are given, part of the text being literal quotations, even where not so marked, and this opportunity is taken of expressing appreciation to those who have recently searched old records in order that the information might be more complete. It is realized that the list is but a partial one of the so-called conflagrations within the period em-

braced; but information is lacking on others. Where no sprinklered properties have been involved, mention of a conflagration is omitted. Enough are given to present both what may be considered the favorable and unfavorable showing of the sprinklered property under the severe conditions.

Paterson, N. J., Feb. 9, 1902.

The first conflagration of which the writer has any record regarding sprinklered properties is that of Paterson, February 9th, 1902, and full details are lacking. It is known, however, that one sprinklered department store in the congested district where the fire started was destroyed. This is believed to be the only sprinklered property that was burned. There is a detailed report, however, of the fine work accomplished by the fire pumps at four sprinklered Mutual Mills outside of the congested district. The mills themselves did not suffer, but would have except for the use of hose streams from their private pumps in the neighborhood, thus stopping the conflagration, almost unaided by the public fire department, a few hundred feet from the mills and saving a district beyond. This experience has been used by the Factory Mutuals as an argument for the fire pump as a secondary supply in a city property.—*Special Pamphlet, Factory Mutuals,* 1902.

Baltimore, Feb. 7-8, 1904.

The next is Baltimore, February 7th and 8th, 1904. The fire started at 10.48 A. M. on Sunday the 7th. Property loss $50,000,000. From the copies of the detailed fire reports which were made at the time and now furnished to the writer by the Underwriters' Bureau of the Middle and Southern States, there were seven sprinklered properties involved, of which two were destroyed by fire, one was blown up by dynamite before fire reached it in an effort to prevent the spread of the conflagration; one was evidently out of the direct line of the flames, suffered only slight damage and no sprinklers opened; with the remaining three, the use of private fire protection combined with other efforts of the property owners was a deciding factor in their salvation, although in one case no sprinklers operated.

The other report available on this conflagration is that of the Special Committee of the National Fire Protection Association, 1904, which deals more largely with the damage to buildings of fire resistive construction than with the sprinklered properties, but describes the last three sprinklered premises above mentioned, the details differing in a few respects. While the normal city pressure is said to have been materially reduced at some of the sprinklered buildings in the detailed fire reports, the special report mentioned comments that at no time was there any shortage of water and that the water level in the distributing reservoir actually rose during the fire. It probably refers to water supply for fire department steamers. A summary of each sprinklered property follows:

Shirt Factory, 112-124 West Fayette Street. Five and six stories brick, joist construction; water supplies to sprinkler equipment, city and gravity tanks of total capacity 18,000 gallons, and a 500-gallon Underwriters' steam fire pump draughting from the city and a 25,000-gallon tank filled from city. The fire pump was started in service about 11.30 A. M.

and supplied the hose with which the roof was kept wet down and probably saved the building from loss. One sprinkler head opened on first floor due to a door tin clad on one side burning through and sprinkler kept the fire from entering. It was supplied by the gravity tank at the time. The overflow pipe of one sprinkler tank was plugged and tank kept running over to prevent it taking fire. It is also stated that the private hose was used to wet down the sprinkler tank on the drygoods store mentioned next. The fire shutters on a part of the windows were also a factor in saving this premises.

Drygoods Store, Lexington and Charles Streets, four and six stories, brick joist construction. Water supplies to the sprinkler equipment were the city and 15,000-gallon gravity tank. This store narrowly escaped destruction, but was protected against the worst attack by a solid brick wall on the south. Windows on the west side facing Crooked Lane were protected by a system of 113 open sprinklers which were supplied by water from the city mains. During the afternoon, part of the curtain had been turned on several times to wash the burning brands from the window sills, and all were kept continuously in operation from about 5 P. M. until about 9 P. M. By the use of buckets the roof and cornice of the six-story building were wet down by drawing water from the sprinkler tank, which was kept filled nearly to overflowing by the city pressure. The sprinkler heads in the attic, which were normally shut off in extreme weather, were opened. The roof boards were ignited from the heat on the tin above and about fifteen sprinklers in the attic fused and prevented fire from spreading, thereby saving the store from destruction, inasmuch as the fire department at that time would probably have been unable to handle a fire in such a building.

Large Wholesale Drygoods House, Liberty and Lombard Streets, eight stories, brick of heavy plank and girder construction. The water supplies for the sprinklers were the city, three 7500 gallons gravity tanks and a 750-gallon Underwriters' steam fire pump. Normal city pressure about 80 pounds. It was found at 50 pounds on February 9th. Credit for saving the property is given to the owners and employees who kept the roof wet down by hose streams from the private fire pump. Blankets were also hung over the cornice and kept wet. At the same time water was pumped into sprinkler supply tank above the roof until it overflowed, and by plugging up the roof drain pipe the water was forced to run over the cornice and form a water curtain down the north front of the building. None of the automatic sprinklers opened. A large amount of glass was broken, but there was practically no damage to the interior.

Meter Repair Shop, 5-7 West Baltimore Street, six stories brick joist construction. Water supplies to sprinklers, tanks of total capacity, 6000 gallons, and an "indifferent" pump. This property and the three-story adjoining exposure were blown up with dynamite about 4 P. M., Sunday the 7th, in an effort to prevent the spread of the conflagration. The fire is said not to have reached the property at the time.

Wholesale Drug House, 16-18 North German Street, six stories brick, joist construction. Sprinkler system old standard, water supplies city and 8000-gallon gravity tank. The building was directly in the path of the fire which is said to have reached it between 3 and 4 P. M. and was destroyed

in a very short time. There were standard fire shutters at some windows, many were badly damaged.

Mercantile, 204-220 West Baltimore Street. The details of the construction and sprinkler protection not given, but the building was only slightly damaged by fire early in the afternoon of the 7th. Three large panes of glass in show windows were cracked and broken by the heat and the paint on wooden cornice was blistered. No sprinklers opened.

Flour Mill and Grain Elevator, 319—to south end of Smith's Wharf. Construction was generally brick, frame metal-clad marine tower, one frame metal-clad store shed; all of joist construction, one to six stories. Practically all equipped with sprinklers, old standard, water supplies, city and a 750-gallon Underwriters' steam fire pump draughting from the harbor. Sprinkler system, wet pipe in the mill and in the Engine and Boiler Room; dry pipe in the elevator, marine tower and storehouse.

A number of the officials and employees reached the premises about 9 P. M. Sunday the 7th, or about ten hours after the start of the conflagration, and prepared to fight the fire. The dry pipe valves were tripped and the roof and sides of the buildings were wet down by private hose and perforated pipe on elevator, all supplied by the city, and later when the city pressure was reduced owing to the draught and the large number of breaks in the fire district, supplied by hose connection from the fire pump.

The fire department could not get on any of the wharves in the vicinity owing to the spread of the conflagration, and any attempt to fight the fire through public facilities was from the fire boat and a police boat also equipped with fire apparatus. The report states that if this force had been adequate and not worn out with fighting all night, considerable of the property in the vicinity might have been saved.

About 6 A. M. Monday the 8th, the buildings at the north end of the wharf were on fire and those at the mill were cut off from escape except by water.

About two hours later it was felt necessary to withdraw and the property was left to its fate. The water was left on the sprinkler system, all valves opened, hose trained on roof and the fire pump running. At that time no fire had actually reached the property, no sprinkler heads had opened and all buildings were thoroughly wet down. By 10.30 A. M. or nearly twenty-four hours after the start of the conflagration, the premises caught fire and burned very rapidly, being nearly a total loss.

Transformer Substation, 6-8 McClellan Street, two high stories, of fire resistive construction. This was not a sprinklered property, but is mentioned as the wired glass windows with which the building was equipped were a factor in saving same.—*Underwriters' Bureau of Middle & Southern States, Feb. 9th, 10th, 13th and 15th,* 1904; *Special Committee of the N. F. P. A.,* 1904.

Toronto, April 19, 1904.

Area of conflagration 19.7 acres; number of buildings destroyed 98, all of brick except a flour mill which was built of stone. Ordinary mercantile wooden joist construction prevailed. Exposed windows as a rule were not protected. Property loss $10,350,000.

There were three sprinklered properties in the burned district, viz., a wholesale dry goods warehouse, a paper bag and box factory, and a newspaper printing establishment.

Wholesale dry goods warehouse, southwest corner Wellington and Bay Streets: This equipment had two sources of water supply, 8000-gallon gravity tank and city water connection; there were also outside sprinklers from the alley windows at the rear supplied by city water. The property did not burn till long after the nearer exposing buildings had gone, the water curtain from the outside sprinklers preventing the fire from entering the windows as long as the water pressure was sufficient to supply all the heads. But the drain upon the city water by the steamers and many hose streams, weakened the pressure until there was no water at the upper floors. It is supposed that the fire then entered the building through the upper windows at the rear and that the automatic inside sprinklers were opened; these, being supplied by a gravity tank as well as city water, held the fire in check until the tank was drained when, there being no more water for the upper floor sprinklers, the fire soon gained headway throughout the building, which was completely destroyed.

Bag and Box Factory, 21 Wellington Street: Supplies for the inside automatic heads were two gravity tanks and city water connection; the outside heads being supplied by city water and an auxiliary steamer connection. The preceding remarks about weakened water pressure also apply here, but the larger tank supply and the good division walls held the fire in check. A good illustration of sprinklers supplementing a standard fire door was noticed in this building. An automatic standard sliding fire door was prevented from closing by some obstruction, so that a space of about six inches wide was left open; six sprinkler heads opened on the other side of the door from the fire and prevented the fire from passing the wall at that point. As above mentioned the sprinklers protecting the windows were supplied only from city mains and when the great draft upon these reduced the pressure, no water was supplied to the heads of the upper windows, with the result that the roof of that portion of the premises fronting on Wellington Street and extending 200 feet to the south was completely burned off, with serious damage at every window, but the sprinklers within these premises prevented the flames securing a firm hold upon it, and the only portion completely destroyed was that fronting on Wellington Street and extending back about 50 feet. Adjoining the rear portion was an addition five stories high, 50 x 75 feet, which was also protected with water curtains upon the windows overlooking a furniture warehouse.

Although this furniture warehouse was completely destroyed and the heat from its burning must have been intense, only a few panes of glass were broken in the bag and box factory. This building also diverted the flames so that they beat on the side instead of the rear of the neighboring premises on Front Street, and to it must be given the credit of having stopped the spread of the fire at that point.

Printing office, southeast corner of Bay and Melinda Streets: This building was also equipped but, though the front of the building was badly damaged, the fire was successfully fought with inside hand hose and no heads opened. Very good work was done at this property with a length of hand hose attached to a roof hydrant.

The N. F. P. A. QUARTERLY BULLETIN, July, 1904, recites how the wholesale dry goods warehouse burned slowly and long before its destruction all of the surrounding unsprinklered buildings had been destroyed. It was a notable example (even with the low pressure) of the effective barrier which a sprinklered building makes to a conflagration fire.

Under the item of salvage, the report by the General Committee of Fire Insurance Companies further notes there was comparatively little salvage but that "the dry goods stocks proved the most remunerative, particularly the salvage taken from the sprinklered wholesale dry goods warehouse. This was a sprinklered building, and it is thought the quantity of water distributed upon the merchandise accounts for the comparatively large salvage." The report adds: "As a rule, any salvage found was in the neighborhood of the outbreak of the fire. As it worked southward it gained in intensity of heat, presenting as a result a completeness of combustion rarely seen even in conflagrations. On Front Street the heat was so great that it was impossible for the firemen to approach, and almost no water was thrown on the premises south of this point. This is clearly shown by the condition of the ruins, and practically no salvage was found in this locality."

This would appear to substantiate the definition of a conflagration by Mr. Blauvelt referred to above; and also proves that the only reliance at times must be in the automatic sprinkler protection.

Minneapolis, Dec. 13, 1904.

In a fire which totally destroyed three unsprinklered buildings, with damage to others, the flames crossed First Avenue 80 feet and communicated to the woodwork under the metal-clad mansard roof of a sprinklered department store, opening 75 heads in the concealed roof space. These heads held the fire in check until the fire streams could be brought to bear on it. The sprinkler equipment had city and gravity tank supplies. It is stated that the city pressure held up sufficiently so that the gravity tank supply, with a pressure of 40 lbs. at the ground level was not called upon. To a bank building of fire resistive construction and the sprinkler equipment in the department store, credit is given for the prevention of the spread of fire to the downtown district. This is taken from a special bulletin to N. F. P. A. members issued December 21, 1904, from the report of the Minneapolis Underwriters' Inspection Bureau.

Insurance Engineering reports that the fire could gain no footing in the department store on account of the automatic sprinklers. The amount of the loss not given.

Indianapolis, Feb. 19, 1905.

Seven buildings involved; loss, $1,000,000.

The fire originated in an exposure to a sprinklered drug house of mill construction, which had unprotected windows and was attacked from two sides. The city water pressure is reported as having been poor. The sprinkler equipment also had a gravity tank supply. The drug house is said to have withstood the fire "for an hour or more, when the flames seemed to spread over it.—*"Insurance Engineering," March*, 1905.

New Orleans, Feb. 26, 1905.

Loss $3,500,000. The fire started in a frame open joist unsprinklered freight shed of very large area, 4600 feet long by 150 feet wide, divided into several fire sections by concrete and vitrified hollow tile fire walls. The shed contained, among other materials, 6,000 bales of cotton, a large quantity of lumber, cottonseed oil, etc. Other frame cotton warehouses containing 18,000 bales, car sheds and other buildings were involved, including one frame metal-clad sprinklered grain elevator. There was said to be no public protection in that part of the city, but there were private hydrants supplied by fire pumps. The sprinkler system is said to have retarded the fire in the elevator for a while, but so many heads opened the water supply was overtaxed. Under the circumstances recited, the sprinklered elevator could hardly have been expected to survive.—*"Insurance Engineering," March,* 1905, *details furnished by Louisiana Fire Prevention Bureau.*

San Francisco, April 7, 1906.

Losses, $350,000,000. Three sprinklered properties were involved, two of which were saved by the activities of their occupants, but the sprinkler equipments were apparently not a factor.

It will be recalled that the earthquake which preceded the fire wrecked or damaged many of the buildings, and put out of service through broken mains the city water supply, at least in great part.

Only one of the sprinklered properties was in the congested district, and was without water for the equipment; but the report states that with the severe exposure and no window protection the result would probably not have been different even if water had been obtainable. The name or character of the property is not mentioned.

Of the remaining two, on one the sprinkler tank remained in operative condition; but the fire pump, which was electric, was out of service for lack of power. The sprinkler piping is also said to have been damaged at the start. Wired-glass windows were a factor in saving this building.

With the other, the sprinkler tank was thrown down by the earthquake, but apparently the sprinkler piping was not injured.

Several cases were reported of heavy tanks on trestles in various portions of the earthquake region, and most of these appear to have survived without injury.—*"Insurance Engineering," August,* 1906, *report by S. Albert Reed, C.E.*

West Lynn, Mass., Dec. 6, 1906.

Loss, $450,000. An explosion in a one-story brick boiler house situated between two frame four story sprinklered shoe factories wrecked the boiler house and a part of one shoe factory, crippling the sprinkler system. The fire destroyed this factory, extended to the other, which was also destroyed, likewise another four story frame sprinklered shoe factory twenty-five feet distant, and caused some damage to a fourth. The city water was the only supply to the sprinkler equipments, except for a small tank in one case. The city pressure is reported as having been weak. There was an open sprinkler equipment on one factory, but it was of no value owing to the poor city pressure.

This conflagration is sadly unique in that it included only sprinklered properties; but the sprinkler system where the fire started was wrecked by the explosion.—*"Insurance Engineering," Dec.*, 1906, *and N. F. P. A. Quarterly, Jan.*, 1907.

Superior, Wis., Nov. 8, 1907.

Loss, $2,500,000. Four grain elevators, three flour mills, one power house, one steam boat, one tug, four dredges, three dwellings, and one barn were destroyed, and numerous other buildings were damaged. The fire started in or close to an unsprinklered low basement of a sprinklered grain elevator, which was totally destroyed. Of the other buildings destroyed, one flour mill and its warehouse and another grain elevator were sprinklered. Fire brands are said to have been carried 3,900 feet, and intervening property between some of the buildings burned was not damaged. The sprinklered equipments were said not to have been modern, and judging from the water supplies given could not have been very efficient.

While grain elevators and flour mills are not really classed as sprinklered properties, not being under "positive sprinkler control," it is desired to comment on the fire starting in an unsprinklered low space or basement. The unsprinklered section is the "curse" or "abomination" of the sprinklered property, and has been the cause of many serious losses in equipped buildings. This statement is not intended to apply to buildings of fire-resistive construction where the occupancy or other local conditions would not require a strict application of the rule for automatic sprinkler protection in all parts.—*N. F. P. A. Quarterly, Jan.*, 1908.

Chelsea, Mass., April 12 and Sept. 21, 1908.

In the April conflagration, 3,500 buildings were burned, covering an area of nearly 375 acres. About twenty lives were lost; monetary loss $12,000,000.

Three scattered sprinklered factories of brick and frame construction were destroyed. Only one appeared to have a tank supply in addition to the city water. City pressure to the sprinkler systems is said to have been of practically no value.

No sprinklered properties were involved in the second conflagration of September 21, 1908.—*N. F. P. A. Quarterly, July*, 1908, *and Oct.*, 1908.

Jersey City, N. J., Aug. 17, 1910.

Loss, $700,000. Here is another example of the effective use of a fire pump in a city building and the value of wired-glass windows.

The fire destroyed a whole block of buildings, originating in a cork factory and involving a rolling mill, a spike mill, a baking powder and chemical works, none sprinklered. The city water supply was said to have been adequate at all times.

The principal interest centers in the block north of the burned district. Immediately opposite the cork works was a four story brick mill constructed sack factory in three fire sections, but with unprotected windows facing the cork works. The sack factory was protected by a wet pipe sprinkler system having as water supplies gravity tanks of a total capacity of 33,000 gallons and a steam fire pump of 750 gallons capacity taking

suction from a 200,000 gallon reservoir. This fire pump also supplied a standpipe in the stair tower.

To quote from the QUARTERLY: "The heat from the burning cork factory soon cracked the glass and ignited the doors and window frames of the sack factory, promptly fusing the automatic sprinklers in the first bay adjacent to the windows, and the water curtain formed thereby was so efficient that no fire entered the building, very little charring or evidence of fire being observed, although the window and door frames were almost completely consumed. In all twenty-six sprinkler heads were in operation, and these, in connection with very efficient aid from employees using fire hose, prevented any further damage inside the building. Several lines of hose were led from the standpipe to the roof and used in keeping off fire at this point, as well as protecting the sprinkler tanks and supports—the iron structure supporting the 15,000 gallon tank shows no evidence of being weakened, although the tank itself was considerably charred. The two smaller tanks and their wooden supporting structures were also badly charred. The entire damage to this plant, mostly water, including the replacement of the gravity tanks, is placed at approximately $2,500."

Adjacent to the sack factory was a large eight story brick mill constructed private warehouse, equipped with a complete wet pipe sprinkler system, and the window openings were protected by wired glass in metal frames. To quote again from the QUARTERLY: . . . "Absolute protection to this plant was afforded by the wired-glass windows, while same were cracked by the heat, there were no sprinkler heads fused, and outside of cracked glass and scorched paint no fire damage to building or contents ensued. As, however, a number of lines of hose were laid and used there will be some damage by water. Between the two plants some 105,000 gallons of water were drawn from the reservoir by the fire pumps.—*N. F. P. A. Quarterly, Oct.,* 1910.

Cleveland, May 25, 1914.

Loss, $678,000. This is included because the flames jumped 300 feet and attacked the top of a grain elevator 150 feet high, passing through open windows. Twenty-eight sprinklers opened and extinguished the fire with a loss to the elevator of less than $7,000. The fire started in unsprinklered property, and it is reported that without the sprinkler protection the elevator would undoubtedly have been destroyed. The elevator stood in the direct path of the fire and prevented it from attacking a large lumber and manufacturing district beyond.—*Special Report by Cleveland Inspection Bureau.*

Salem, Mass., June 25, 26, 1914.

The conflagration burned about one-third of the city, the property loss being about $16,000,000; number of buildings burned, 1,600; area of the burned district, 251 acres. Salem was largely a frame town, with many shingle roofs. A large percentage of the water mains consisted of cement-lined pipe which could not stand a heavy pressure.

Ten sprinklered properties, including a large cotton mill, were practically destroyed.

Of the nine sprinklered properties, aside from the cotton mill, eight were of frame construction and four had the city supply only. Seven

were totally destroyed. In one of the remaining two, a fire wall with fire doors divided into two sections a three story wooden shoe factory. The fire wall held the fire so only one section was destroyed. The other property was likewise a three story frame shoe factory with the walls covered with slate. The sprinklers were supplied by city water and a 20,000 gallon gravity tank. The top story was burned off after the sprinkler tank was exhausted, but the city pressure on the sprinklers was sufficient to save the two lower stories. No assistance from the fire department.

The cotton mill was of very large area, the main manufacturing buildings five stories high and of good mill construction with brick walls. There was a large one story weave shed with sawtooth roof, a four story fire-resistive concrete storehouse for finished goods and other buildings. It was sprinklered with the city water and two 1,000 gallon steam fire pumps for supplies. It presented a front of about 1,500 feet, mainly unprotected to the oncoming conflagration, which reached the mill about five hours after its start. With hose streams and sprinklers good work was being done through the fire pumps, the city pressure being only 10 lbs. at the time, when one of the fire pumps broke down. Many men of the mill staff had also left, their homes having been destroyed, so there were not enough to man the hose. Before the broken pump could be repaired, in about twenty minutes, the fire gained such headway that it was impossible thereafter to raise a good pressure. The smoke and heat also made it impossible to remain at the mill, and to save their lives the remaining men left, and the mill was left to its fate. The public fire department was not of service.

It is remarkable, however, that two storehouses, one for cotton and one for finished goods, that were exposed to the full force of the conflagration, but presented to it blank walls or wired-glass windows backed with inside tin-clad shutters, came through with practically no loss, and no sprinklers inside fused. The fire-resistive unsprinklered electric light and power station with wired-glass window protection located in another part of the town also came through practically unharmed, but was not subjected to so severe an exposure fire. Three men are said to have remained in the building and kept the interior wet down and prevented the heat which radiated through the windows from igniting combustible materials.—*Special reports by Factory Mutuals, Underwriters' Bureau of New England and N. F. P. A.*

Paris, Texas, March 21, 1916.

Property loss about $10,000,000. Buildings burned, 1,440. Area burned, over 264 acres. Ninety per cent. of the buildings were frame, many shingle roofs. Two sprinklered buildings directly in the path of the fire were destroyed. These properties practically adjoined each other in the same block and were of ordinary joisted construction, with brick walls, three and five stories in height, the first a department store and the second a wholesale dry goods establishment. A third sprinklered property diagonally across two forty-foot streets from the wholesale dry goods building was on the edge of the burned district on both of the streets on which it faced. This was a harness and saddlery factory and warehouse; and wholesale hardware and machinery warehouse, one and two stories in

height, of ordinary joisted construction with brick walls. Each property was equipped with a wet pipe automatic sprinkler system with city and gravity tank supplies, and with unprotected windows at street fronts in all cases.

At the suggestion of Mr. S. W. Inglish, State Fire Marshal, and others, direct inquiry was made of several of the property owners and of one of the insurance agents. The following is taken from their replies in August and September, 1920:

From the president of the department store:

" . . . It is our opinion that the automatic sprinklers with which our building was equipped retarded the fire some 40 or 50 minutes as the writer was in the building when it caught on fire.

"The gravity tank was the only value, as the city pressure was reduced to almost nothing. The facts in the case are, when the fire reached our building it had covered a space two or three blocks wide and almost a mile long, and dozens of houses burning at the same time in different parts of the city, so many water connections having been broken off or left open that it was impossible to force the water up into the tank after it had become empty. There was not enough pressure to enable the writer to use the hose in building."

The owner of the third sprinklered property mentioned advises that when the unsprinklered hotel exposure 60 feet distant burned, the front automatic sprinklers inside the equipped building were brought into action by breaking fuses by hand, but a change in the course of the wind is ascribed as the biggest factor in saving the building. The damage is reported as having been from water from sprinklers, broken glass in front of building and blistering of paint caused from other burning buildings. The amount of the loss in this building is not furnished.

From the insurance agent:

" . . .Very little can be said as to the actions of the sprinklers in these two buildings (those destroyed). We do know, however, that the wholesale dry goods store was about thirty or forty minutes catching, because of the good work of the sprinklers. This building (a five-story structure) was across a thirty-foot street from a large three-story hotel, which created an immense fire and an intense heat, which put all the sprinkler heads in the dry goods house to work, but the heat was too great for them and the entire upper story burst into flames.

"We do not see how any estimate can be placed on the value of the gravity tanks or the city pressure. These were in the heart of the fire district and no one could be very near when they were burning. The writer stood on the opposite corner while the wholesale house was burning, but had to move on account of heat when the retail house caught. The city pressure could only have been practically nil, as there were so many lines of hose attached all around, and it was poor at best.

"The third risk may have been saved by the veering of the wind, but it looked more like a miracle to the writer, as large brick buildings burned on both sides of it.

"The two sprinklered risks referred to had no chance to demonstrate their value in such a terrific fire."—*Special Bulletin N. F. P. A.*, 1916; *Mr. S. W. Inglish, Texas State Fire Marshal; Mr. C. M. Ragland, insurance agent; and several of the property owners, Aug. and Sept.*, 1920.

Augusta, Ga., March 22, 23, 1916.

Property loss, $4,250,000. Buildings destroyed, 141 business and 541 dwellings; two buildings of fire-resistive construction. 168 acres burned over. There were many shingle roofs. Low water pressure. Large amount of cotton stored in the streets.

The special report issued by the N. F. P. A. is largely silent as to the sprinklered properties; but the following is submitted from a letter under date of March 6th, 1920, from the South-Eastern Underwriters' Association:

" . . . In Augusta the conflagration completely destroyed several city blocks on one side of Reynolds Street. Across Reynolds Street, which is a 60-foot street, were located some eleven or twelve cotton warehouses. The wind was not blowing directly against these warehouses, but burning embers were falling into warehouse courts and all over them continuously. The eave sprinklers on the warehouses were cut off and on during the progress of the fire, and probably did prevent serious fires in most of the warehouses. Owing to the draft on the city mains and the many hydrants left open, the city water was of little or no value. Several fires were extinguished with sprinklers until the 50,000 gallon tank forming secondary water supply to sprinklers was exhausted. It was then that the fire went through one of the four compartment warehouses and completely destroyed it, causing a fire insurance loss of approximately $250,0000. The other losses by cotton were nominal, none of them running over $1,000 in the sprinklered warehouses."

Atlanta, May 21, 1917.

The area of fire about 300 acres. Total number of buildings involved was 1,938, of which 47 were brick and 1,891 frame. Classified by occupancy, there were 1,537 dwellings and apartments, 42 mercantiles, 351 garages and outhouses and 8 miscellaneous occupancies, including churches, schools, special hazards and warehouses. Of the total number of buildings 1,682, about 80 per cent., had shingle roofs.

The property loss was about $5,500,000, and about 10,000 people were made homeless.

The special report by the National Board of Fire Underwriters shows there were three fires closely following each other before the start of the conflagration, and that the building where the first fire started was being equipped with automatic sprinklers which, however, were not in service.

Only one sprinklered building, a laundry, was directly exposed to the conflagration. To quote from the report:

"This laundry and adjoining boiler room and stable were of brick construction, one story in height and with unprotected windows. Area of main building, 10,434 square feet. Sprinkler protection, covering the entire building, consisted of a dry-pipe system, with only supply from the 6-inch municipal main, giving 50 to 55 pounds static pressure on the highest line of sprinklers. An inspector of the Sprinklered Risk Department of the South-Eastern Underwriters' Association reached the building when the fire was about two blocks distant. The inspector tripped the valve and closed all windows and the monitor. He reports that four heads were open before the windows went out. A total of 79 heads were opened, and did excellent service in preventing the spread of the fire in the building, the heads on the first line forming a water curtain.

The fire department had concentrated several companies in and about this neighborhood, and officers report playing lines on the window casings at various times. The sprinklers undoubtedly were an aid to the department in preventing the direct travel of the fire at this point to beyond Edgewood Avenue, and practically all the buildings in this block were either uninjured or only partially destroyed. The exposure was not excessive, being from small frame buildings 45 feet distant.

The following extract from a letter from the South-Eastern Underwriters' Association, Atlanta, is of interest:

"The only sprinklered property which was in this conflagration was a laundry. This laundry is located on a narrow 40-foot street. On the other side was located a solid block of light, frame shingle roof negro dwellings. The Atlanta conflagration started at that block of negro dwellings, and the wind carried the fire directly against the laundry, which was sprinklered with a one-supply dry-pipe sprinkler equipment. Our inspector had gone into the building and tripped the dry-pipe valve during the progress of the conflagration. Fire burned directly into the laundry. In this instance, however, the city water pressure and volume was entirely adequate, and as a result the two lines of sprinklers nearest the severely exposed wall operated and kept the fire out, and total loss to the laundry was about $6,000. In this connection I would state there was no outside protection, such as open sprinklers or wired-glass windows in metal frames. Fire burned out every single window and door frame on the wall exposed, but the damage inside the building was hardly noticeable excepting for the damage caused by the operation of the sprinklers."

Halifax, N. S., Dec. 6, 1917.

The primary cause of this disaster was a terrific explosion of war material due to a collision of two vessels in the harbor, and the conflagration which followed is not really within the scope of this article. Approximately 1200 lives were lost, with many injured and a large number of buildings were demolished or partially wrecked by the explosion. The total property loss is not available, but greatly exceeded that in which there was any fire loss, the total property value involved under the fire loss being about $2,000,000. It may be of interest to note that a brick sprinklered sugar refinery of large value within a short distance from the seat of the explosion was completely demolished; as was also a small sprinklered frame foundry a considerable distance away. Six other sprinklered properties were more or less damaged, either from partial collapse of buildings or from frozen equipments due to broken windows and the failure, in the excitement, to drain the piping. Only one sprinklered property suffered any fire damage, and that was a large cotton mill, with an approximate loss of $435,000. The fire was caused, it is supposed, from an exposure and the sprinkler protection was not available because of the effects of the explosion. A remarkable feature connected with this disaster as noted in the Quarterly of April, 1918, was that a number of sprinkler tanks on trestles within the area of the concussion were not damaged.—*"Statement of Explosion Damages where Fire Ensued in Specified Cases," compiled by the insurance adjusters, Halifax, Dec. 5th,* 1918; *Nova Scotia Board of Fire Underwriters, Halifax, Dec.,* 1917, *and Aug.,* 1920.

The Blind Attic Flue.

This photograph shows how a concealed attic space acted as a flue to spread the fire which destroyed St. Paul's Church, Newburyport, Mass., April 27, 1920.

The fire was discovered about 4 a. m. burning on the roof of the parish house. This is the addition at the rear of the church, appearing at the right in the picture. The firemen came promptly, and in a few minutes apparently had it well under control. Then, without any intermediate appearance, flames broke out in the tower, having travelled, unseen, through the blind attic over the church proper. Two hours later the fire was extinguished, leaving the church as shown in the picture. Loss, $60,000.

Fire Department Inspection Work.

By Fred Higgins,

Assistant Fire Marshal, Grand Rapids, Mich.

All members of the Grand Rapids Fire Department give eight hours a week to inspection and other fire prevention work, such as talks at schools, clubs and churches. This time, taken during the off shift of a two-platoon system, was originally traded by the firemen for the inception of the two-platoon system. Men are on duty from 7 a. m. until 7 a. m., and off duty the next twenty-four hours. Inspection work is kept up by men from the off shift, who each give up an eight-hour day per week for inspection work.

The city is divided into districts. Each fire station has its own district, and the captain of each station is held personally responsible for the conditions of his district, which includes all buildings, dwellings as well as public and business buildings. Inspections are made by men who have had experience. New men are educated in this work by working with experienced men. No man is allowed to have any arguments while on inspection duty; he must be courteous and civil at all times, reporting any irregularities to the officer in charge. In difficult cases he reports to a Chief Inspector, who has authority to handle any such matters as may arise. The Chief Inspector works entirely with company officers, keeping check on all operations and doing special inspection work, including the covering of all theatres.

The method of inspection is illustrated by the inspection card reproduced on the opposite page. The front of the card shown is used for the first inspection. The reverse provides space for noting eleven re-inspections. This card is a record of an inspection made July 30, 1920, by Ladderman J. Craig, of No. 4 truck. Upon his return to his station, the company officer in charge takes his cards and checks up with the inspector. Note that rubbish and ashes were found and dated, which is permanent on this record. The next day inspections are made by men who are on the off shift, and their cards are checked by the officer in charge upon their return. All cards that call for returns are now in company officers' hands, who, on their eight-hour duty, follow up all complaints and recommendations made by inspectors. Notice checks (in red on original card, although appearing black in reproduction), indicate that company officers made three return calls before being satisfied with conditions. When cards are O. K.'d by company officers they are placed on file by streets. In case of a fire full particulars are carried on sheet of paper the same size as the card and attached to card.

The cards are shown to the public after first records are made, particularly in cases where we are having trouble to get results, and inspectors always impress upon the people's minds that insurance people can also see these cards, which is very effective. In case of a fire of

DATE 7/30 INSPECTOR J. Craig STATION NO. 5

LOCATION 424 Ottawa Ave. NW
OWNER J. Smith
OCCUPANT Same
OCCUPIED AS Store 2nd Dwelling
KIND OF BUILDING Brick 2½ Frame
ROOFING Gravel
NO. STORIES Two
SKY LIGHTS Front 2nd rear wire glass
ACCESSIBILITY Front 2nd Rear
ELEVATORS None
STAIRWAYS 1 Cabinet - 1 Front Hall - 1 Alley
FIRE DOORS Separate Stairs from rear room
TRAP DOORS No
PIPE IN SHAFT HOLES No
FIRE ESCAPES Platform So. side
NO. 1 LOCATION So. side
AUTOMATIC SPRINKLERS No
CONDITION
EXTINGUISHERS 2 - 3 gal - Babcocks

PAILS No
CHIMNEYS - one from furnace
STOVES FURNACES X STEAM
CONDITION In good condition
HOW LIGHTED Electricity
OIL RAGS
WASTE PAPER
RUBBISH Little
ASHES Little
EXPLOSIVES
OILS Kerosene 4 gal.
HOW STORED underground
ELECTRIC WIRES In Conduit
REMARKS Occupant careless - Should be called on every two weeks

Specimen Inspection Card.

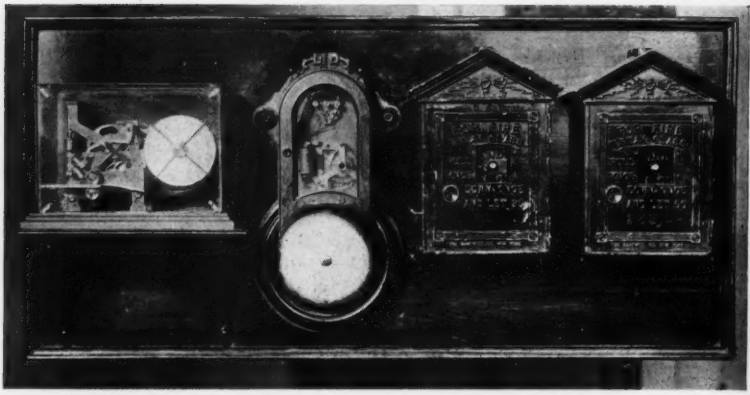
suspicious nature full particulars are attached, and if persons move into a different district of the city the captain of the district from which they move notifies the captain of the district into which they move, a new card is made out and the persons notified that we are going to keep watch of them; and on the company officer's special list, kept where extra calls are to be made, this address is added. Instead of sending men into districts and places that do not need it, by the use of special lists men are kept in the "careless parties'" places until our next regular trip is started. We inspect everything and have a card for every building.

It is practically impossible for an inspector to loaf, because company officers will have different men inspect the same building at another inspection, thereby causing each inspector to pay sharp attention to his own work, knowing that his work will be followed by another man.

Company officers are entirely responsible for their districts and they do their own planning. Through the districts occupied by foreigners we find our greatest aid is by having announcements made in churches and clubs preparing people for these inspections.

Three trips a year are made to all concerns employing night watchmen. Our men stay, if necessary, all night, and make the trips with night men, thereby learning buildings and yards by night, as well as satisfying themselves that the night men are properly familiar with the fire responsibilities of their positions. We get permission to make these calls, and invariably are invited to let the management know what is found.

We also have company officers with some of their men visit all buildings where night watchmen are employed. They question the night watchmen on matters pertaining to fire service; such as special equipment, fire alarm boxes, and what to do in case of fire, describing minutely the route



Portable Panel used in school demonstrations. (See opposite page.) Pupils can learn how to send an alarm, and see the receiving and recording apparatus in operation.

that alarms sent by different methods travel, before a wheel turns from the fire station. They warn them about telephone alarms—advising them to use different means when provided. We also go into detail as to what to do after turning in an alarm, and in regard to the sprinkler systems. This same care is taken with school janitors.

For enforcement of our orders we rely principally on publicity and public information. We use these to the limit, but do not rely entirely on them.

We have a very good building code, and everything we encounter is covered by city ordinances or State Fire Marshal's regulations. Inspectors never let up until they get results. We have convictions in every case we ever started, but we will go a long way with first offenders, hoping to get what we want without trouble, and afterwards make them like it.

After doing 30,000 inspections last year—ordering corrections in about one out of five inspections—we were able to come through with but two prosecutions, and in each case parties were fined and the cases given considerable publicity through the daily papers.

We furnish uniformed men with equipment at all large gatherings, when necessary and when requested to by any group. Also we furnish uniformed members to give talks to any gathering or society meeting, churches, clubs, public schools, etc. We have always paid special attention to schools and school children. We find that excellent results are obtained through noon-hour talks in factories, especially now when so many girls and women are employed. Calls for men to give talks of this kind are increasing very fast.

Uniformed men visit every school in the city at least once a year, and some schools oftener, and give demonstrations in fire extinguishment, fire prevention talks, and talks on how to act in case of fire. We keep on each teacher's desk, throughout the city, fire statistics and other fire matters that make it possible for teachers to have a little lesson at any time.

For use in school demonstrations we have mounted on a movable panel (see illustration) a complete sending and receiving alarm system. This is so arranged that a box can be pulled and the signal transmitted, received and recorded in plain view of everyone in the room. This always receives the undivided attention of the audience, and gives invaluable instruction in the method of operating the alarm.

It is through school teachers, school children and school janitors, also the newspapers, that lasting results are obtained.

Preventing Paper Accumulation.

From Factory.

One of the hardest clean-up processes around most plants is the job of keeping waste paper from drifting into corners and preventing not only an untidy but a dangerous accumulation. Somewhere around nearly every group of buildings there is to be found a whirlpool effect, so that everything light, such as waste paper, blows into a certain corner or under some particular platform.

One paper goods manufacturer in the East had this matter called to his attention in an unpleasantly forcible manner not long ago. The receiving and delivery platform at this plant was of wood, located in such a way as to allow all the blowable riffraff of the plant to accumulate beneath it. This platform is open and extends along the full length of the rear of the building, about five feet from the ground.

In a few days a good-sized amount of light rubbish, mostly paper, would accumulate. It had been thought that a monthly cleaning out of this space was sufficient. A fire, however, resulted in more definite measures being taken at once. The open sides are now fitted with wire screening, which serves as a barrier for waste paper carried by the wind. It is an easy matter to gather these papers often and get rid of them properly, along with the waste from shop and office.

Wire screening around open platforms not only gives the whole plant a more clean-cut and businesslike appearance, but does away with a lot of labor in seeking to prevent this hazard.

Private Fire Brigades.

The purpose of this article is to show the value of employees organized and drilled in a private fire brigade in the extinguishment of fire. If the brigade has proved incapable of extinguishing or holding a fire in check, the reasons for this failure are given in order that members having plants embodying similar conditions of construction or protection may take steps to remedy the same, or to render their fire brigade more efficient. Outside of a sprinkler system, the private fire brigade may be considered of the first importance as a fire-extinguishing agent by the management ot a well ordered plant.

The information contained in the table on the opposite page was taken from fire reports received by the N. F. P. A. Department of Fire Records within the last two years. In many fire reports the information concerning private fire brigades was either insufficient or wholly lacking. For purposes of comparison the table has been divided into two divisions, organized and unorganized. Under organized fire brigades only those reports are tabulated which contain explicit data as to the functioning of a regularly organized and drilled private fire brigade. Reports of fires in which a number of employees, either quite inexperienced in fire fighting, or with a very rudimentary knowledge, were a factor are included in this tabulation under "Unorganized." These divisions have been made to determine the relative effectiveness of employees trained as a unit and instructed in the use of fire-fighting apparatus, and employees with only a casual knowledge and with no organization. As the sprinkler system has become very essential in the protection of property against fire and where installed is generally a vital factor in fire extinguishment this table has been further subdivided in order that the relative importance of private fire brigades to sprinklered and unsprinklered properties may be demonstrated.

From the table it will be seen that in 24 fires the organized private fire brigade is registered as a failure; 10 times in sprinklered properties and 14 times in unsprinklered. In no case was ignorance attributed as the cause for failure; in four instances the lack of proper fire protection handicapped the brigade, preventing them from holding the fire; in five instances the hazard of occupancy was too severe—fires of this nature usually start with a flash, burn rapidly, and are discovered when beyond control; and in fifteen instances poor or sub-standard building construction aided in the spread of fire—unprotected openings, oily floors, shingle roofs, frame partitions. Even the most skilled of fire fighters are often baffled with such odds against them.

Out of 100 fires recorded the unorganized brigades have 44 failures against them; of these 20 are attributed to ignorance, 8 to poor protection, 4 to severe hazard, and 12 to poor construction. For ignorance there is no

excuse and only one remedy. Proper fire protection both inside and outside depends on the farsightedness of the owner, and is often omitted through a mistaken sense of economy. Hazardous operations can not be eliminated from industry but if properly safeguarded and cut off from the remainder of the property their hazard is minimized. The evils of

PRIVATE FIRE BRIGADES

	ORGANIZED					UNORGANIZED				
	Sprk.	%	Unsprk.	%	Total No. of Fires	Sprk.	%	Unsprk.	%	Total No. of Fires
Effect of Brigade										
Not a Factor	5	10.0	..	....	5	..	....	..	....	..
Aided Spr'kl'r in Ext.	19	38.0	..	....	19	8	16.0	..	....	8
Ext. Unaided	10	20.0	25	50.0	35	12	24.0	11	22.0	23
Held Fire in Check	6	12.0	11	22.0	17	14	28.0	11	22.0	25
Failure	10	20.0	14	28.0	24	16	32.0	28	56.0	44
	50	100.0	50	100.0	100	50	100.0	50	100.0	100
Means of Extinguishment										
Hose	35	70.0	36	72.0	71	34	68.0	30	60.0	64
Chem. Ext'g'rs	4	8.0	7	14.0	11	6	12.0	8	16.0	14
Hose and Chemicals	5	10.0	2	4.0	7	7	14.0	7	14.0	14
Water Pails	1	2.0	..	....	1	1	2.0	1	2.0	2
Sprinklers Alone	5	10.0	..	....	5	..	....	..	....	0
Miscellaneous	..	....	5	10.0	5	2	4.0	4	8.0	6
	50	100.0	50	100.0	100	50	100.0	50	100.0	100
Failure										
Ignorance	..	....	..	....	..	10	62.5	10	35.7	20
Poor Protection	3	30.0	1	7.1	4	1	6.2	7	25.0	8
Severe Hazard	3	30.0	2	14.3	5	3	18.8	1	3.6	4
Poor Construction	4	40.0	11	78.6	15	2	12.5	10	35.7	12
	10	100.0	14	100.0	24	16	100.0	28	100.0	44
Time										
Day	33	66.0	21	42.0	54	35	70.0	26	52.0	61
Night	17	34.0	29	58.0	46	15	30.0	24	48.0	39
	50	100.0	50	100.0	100	50	100.0	50	100.0	100
Loss										
Small	39	78.0	33	66.0	72	33	66.0	23	46.0	56
Large	11	22.0	17	34.0	28	17	34.0	27	54.0	44
	50	100.0	50	100.0	100	50	100.0	50	100.0	100

sub-standard construction can be materially lessened by good housekeeping; unprotected openings can be protected by fire doors, shutters and traps; and wooden shingles can be replaced with fire-resistive roof coverings.

A private fire brigade in itself is worthless unless supplemented by adequate inside and outside fire protection. The value of a private brigade

lies in the fact that its members are employees and in most instances are near at hand to attack the fire in its incipiency. They are acquainted with the layout of the plant, know where to locate the fire apparatus if there be any, and should be able to reach the seat of the fire and extinguish it with the least damage to the property. If the fire has gained too great headway before discovery because of sub-standard construction, or if after they arrive the hose bursts when pressure is applied or the water pails are found empty there is little the private fire brigade can do, and generally as a result of these defects there is little the public department can do on its arrival other than save the neighboring property.

The private fire brigade is of principal value where the fire is discovered while it is yet small or has not yet reached professional fire-fighting proportions; although certain large industrial plants employ for the direction of their private fire companies, former officers of public fire departments. Concerns like Armour & Co., the Ford Motor Co. and the du Pont Company find it profitable to hire experienced firemen to protect their property from fire.

If the plant is not sprinklered the need of first-aid hand fire protection is especially necessary. One small chemical stream in experienced hands at the start of the fire may be worth more than six hose streams fifteen minutes later. In 19 fires in unsprinklered properties as tabulated, the loss was over $50,000. It seems strange that in those unsprinklered properties located in remote districts far from efficient public protection, in buildings almost invariably of frame construction and with very inadequate private protection, there was no organized private brigade. Their only hope in case of fire was centered on a volunteer fire department from a neighboring town—or on an insurance policy. Private fire apparatus in the hands of ignorant employees is little better than none at all—a pail of varnish will never extinguish a fire. The fire loss in industrial and commercial plants can be greatly reduced if owners can only be induced to supply proper fire extinguishing apparatus for their properties, and educate their employees in the use of it through the organization of the private fire brigade.

The following extracts from fire reports used in the accompanying table are selected as typical instances of the work of private fire brigades. These are subdivided into Unorganized Brigades (mostly unsuccessful) and Organized Brigades, successful and unsuccessful.

Unorganized Brigades.

H-15161. Starch Factory. Fire occurred in a frame asbestos-lined starch dryer from a hot bearing on fan. An employee discovered fire in dryer and extinguished it with a hose line from standpipe. He then reported the fire at office. Fire had meanwhile spread through a frame partition of dryer, and aided by light wooden construction soon was beyond control. A few lines were laid from hydrants outside by employees and public fire department, and surrounding buildings were wet down. This building was completely destroyed.

H-15128. Glass Bottle Works. Watchman discovered fire about 4.30 A. M. around furnaces. He ineffectually used two extinguishers and then tried to use hose from standpipe, but plug was frozen. He then

notified manager by telephone, who in turn called employees. After some delay fire pumps were started and several hose lines run to fire from hydrants, confining blaze to furnace building (frame) which was burned to the ground. Loss $75,000.

H-16080. Metal Worker. An employee discovered the fire on the first floor and tried at once, unsuccessfully, to notify the fire department by telephone. A public fireman noticed the fire from a distance and sounded the alarm, 10 minutes elapsing from discovery of fire until arrival of fire department. Employees had one line of hose on fire. Several lengths of private hose used by fireman burst and further delayed the fire department in getting into action. Fire spread rapidly, due to frame partitions, oily floors and overstocked wookrooms.

H-15794. Dye Works. A small fire occurred in a dryer in operation and although the room was equipped with steam jets and hand fire apparatus in good condition, employees were unable to hold the fire which spread rapidly among yarns in the room. Firemen confined fire to the second floor after contents and woodwork on that floor had been seriously damaged.

H-15954. Car Barn. An employee discovered fire about 1.30 P. M. and immediately attempted to fight fire with a stream from standpipe. This stream proved futile, as the fire was too far advanced. The town volunteer department called by telephone arrived, after some delay, took over the private stream, and laid two of their own. The light wood joisted frame and shingle roof of the barn made ready fuel for flames. Five cars were removed to safety, the remainder destroyed. Building practically burned to ground.

H-16484. Coffee Mill. Fire occurred in this isolated property about 2 A. M. and was fought by watchman and plant fireman with a small hose. There was considerable smoke on this floor and as no flame was in evidence, the stream was shut off, and the men set to work to move coffee. Soon the flame burst forth again, and before hose could be applied had gained such headway that the heat drove men from the floor. Volunteer Department was called by telephone, but arrived to find the plant burned to the ground.

S-20337. Clothing Factory. Fire occurred from a gas-heated pleating machine and due to the ready flammability of material spread quickly to paper patterns hanging on wall. Employees were unable to check fire with chemical extinguishers. Sprinklers operated and extinguished fire—small loss.

S-25333. Furniture Factory. A spark from stack ignited sawdust on roof. In the excitement an employee threw a pail of varnish on fire. Fire extinguished by water pails.

S-27628. Cotton Mill. Fire occurred in the opener and spread to the loose and baled cotton in room. One hose stream, 40 carbon-tetrachloride extinguishers and water pails were used. Very poor attack upon fire and lack of knowledge in handling cotton permitted fire to destroy 80 per cent. of the cotton without sufficient heat to open sprinklers in room. A large quantity of cotton was consumed after being removed to the yard.

S-27557. Cotton Mill. An employee discovering fire in blow

room ran into the card room leaving the fire door open and allowing the fire to enter. The fire followed a steam pipe up to the roof, igniting it. Mill help had put out fire in card and mule rooms when fire was observed breaking through roof. Sprinklers aided materially in checking fire until fire department arrived.

S-27601. Cork Works. Fire of unknown origin was first noticed by an employee. One hose was put on fire and eight extinguishers discharged without effect. All sprinklers on that floor, 52 in all, operated and checked fire until volunteer fire department arrived and extinguished fire with one hose line.

S-26486. Furniture Factory. Fire occurred in varnish-spraying booth and spread quickly to a large stock of freshly varnished tables nearby. A number of sprinkler heads opened and might have held fire to a small area if the employees had not impaired the pressure by using four hose lines from yard hydrants which are connected to sprinkler mains. Damage, most to stock on the floor, about $25,000.

S-22522. Fertilizer Plant. Fire occurred on the 4th floor of tank house and spread slowly at first due to lack of combustible material. A half-hearted attempt was made by employees to use standpipe hose on that floor, but was soon abandoned. Fire communicated to lower floor through openings where large amounts of tallow and grease soon produced a very fierce and smoky fire. Sprinklers were not a factor, system shut off. Volunteer Department, consisting mainly of employees of this and a neighboring plant, stretched two lines from the hydrants of an adjoining property supplied by an 8-inch dead-end main, which were very weak and ineffective. The fire practically burned itself out.

S-25170. Linoleum Factory. The employees got three hose streams into action almost immediately upon discovery, fighting fire through the windows. The effect of bringing these streams into play was to reduce the pressure on the sprinklers, as these streams have just about the combined capacity of the pumps. The 16,000-gallon gravity tank, the first supply for sprinklers, was soon emptied by the initial opening of a large number of heads. Both the Superintendent and Chief Engineer were absent from property, leaving no competent man on premises to direct operations. Fanned by a strong wind the fire swept unchecked through the plant.

H-16222. Foundry. Watchman discovered flames near core ovens and immediately called several employees, who ran a line from the yard hydrant, the watchman starting the 750-gallon fire pump. This fire was quickly extinguished and a heavy loss averted through the prompt action on part of watchman.

H-15508. Cotton Seed Oil Mill. Fire was discovered by an employee in fertilizer building. Employees responded with 200 feet of hose, but when pressure was turned on one section of hose burst. By the time section was replaced fire had gained such headway as to render stream ineffective. City department stretched several lines from private hydrant but due to intense heat of fire and weak pressure, streams were soon abandoned. Fire burned itself out.

H-15643. Leather Worker. Watchman discovered flames com-

ing from viscolizing room and gave alarm. Employees used a 40-gallon foam extinguisher with some success but were unable to extinguish fire, being forced to fight from a distance. No hose was available. Four public hose streams used by fire department prevented fire from spreading, building itself destroyed.

H-16048. Foundry. Radiated heat from oven ignited frame shed. Fire was fought by employees with one small hand hose used to wet down sand with little success. Fire department confined fire to shed with one hose stream.

H-16471. Tannery. Molten sulphur set fire to canvas covering over idle motor. The fire spread rapidly to walls and roof. No inside protection at hand. Employees turned in alarm and succeeded in bringing one private hose from hydrant into action before fire department arrived. Considerable loss to building and contents.

H-16233. Car Barn. Fire had gained good headway when first discovered. One very poor hose stream was used by employees with no effect whatever. Entire building in flames when public department arrived and very little could be done to prevent total destruction.

H-15952. Lumber Mill. Fire started in main mill and spread quickly owing to light frame construction, completely destroying this mill. Employees were able to save adjacent planing and sorting mills, using six private hose streams. Had there been a high wind the fire would easily have embraced the entire plant, largely of frame construction.

H-15121. Airplane Factory. During a test, a motor back-fired and ignited accumulated gases. The fire rapidly spread over the entire building because of oil-soaked condition of floors. Employees played a few streams on fire without effect. Building burned to ground.

H-15871. Saw Mill. Fire occurred in basement near steam engine which was enclosed by frame partition to exclude sawdust. Sawyer smelled smoke and upon opening the door to investigate, the flames burst out and spread so quickly through basement that employee carrying a hose from standpipe in basement was forced to drop it and run. The mill was open at either end and in the face of a fifty-mile gale very little could be done. The mill pump was between mill and boilerhouse. Employees were unable to get near it and fought fire entirely with water buckets. A total loss, $150,000.

Organized Brigades.

UNSUCCESSFUL AND PARTLY SUCCESSFUL.

H-14825. Salt Works. A gas explosion blew off hand hole plate on top of boiler and ignited woodwork of roof. An employee discovered fire. When fire whistle was blown the foreign fireman immediately deserted fire room and fled. The plant fire brigade used all the private hose available, small half-inch hose, with little effect. The fire burnt itself out, but was prevented from spreading. Main plant has been rebuilt since with no improvement in outside protection.

S-23761. Munition Plant. Fire occurred in the trinitrating house. An overheated nitration kettle blazed up and overflowed, the blazing liquid igniting everything combustible. The fire brigade had three

streams on the fire almost immediately but were unable to get close enough to render effective work. The sprinklers operated promptly but the T.N.T. ignited with such rapidity that they failed to check it. The flames soon spread and embraced the entire plant via the flaming liquid. Just before the neutralizer building became involved several employees knocked out the fusible links of sprinklers with a hammer with the idea of drenching building to prevent ignition. This did very little good and merely reduced the pressure. Loss, $100,000.

S-25098. Oil Refinery. Fire occurred in basement at foot of bucket conveyor and spread via conveyor to third floor over greasy belting. A large number of sprinklers operated and due to low pressure from a 4-inch city connection were unable to hold fire. The private brigade was called and used one hose stream. Public department arrived and soon controlled the fire.

S-25309. Lead Pencil Factory. An explosion wrecked sprinkler system and dismantled pump. Two lines of hose were laid from the yard hydrants of a neighboring plant by the private fire brigade and fire was confined to building of origin.

S-25636. Celluloid Worker. Fire was caused by material in camphor reclaiming kettle becoming overheated and fumes escaping into room. Celluloid scrap ignited, and caused an explosion which wrecked sprinkler system. Fire was extinguished by ten hose streams manned by private fire brigade and public fire department.

S-25948. Glass Works. A hot blast from regenerating chambers set fire to wooden flooring above. Sprinklers could not hold fire due to its fierceness and its location above the sprinklers. In a short time fire had so weakened wooden joists and flooring that floor collapsed. The plant brigade and town fire department used six hose streams in extinguishing fire.

S-15895. Cotton Seed Oil Mill. Fire started in large frame metal covered storage house from a cigarette butt dropped among the seed. Fire was fought by plant brigade and public fire department but was too far advanced before efficient protection could be brought into play. Building and contents practically destroyed.

H-16228. Bleachery. A spark from locomotive ignited the high grass surrounding plant. Fire brigade plowed ground around the property with a tractor to prevent spread of fire. The wind changed about 6 P. M., blowing a gale. Sparks passed over plowed ground and ignited exposed bales in yard. Fire spread rapidly among bales and was not extinguished until a large part had been consumed. Loss, $90,000.

H-16213. Lumber Mill. The fire had gained such headway when discovered about 11 P. M. that it was impossible to use any of the hose inside saw mill. The fire brigade directing all the streams against the planing mill and lumber shed succeeding in saving these buildings.

H-15817. Pottery. The plant was very dry and dusty and was burning fiercely when discovered. The private fire brigade, although they had good hose streams, were only able to prevent fire from spreading.

S-25887. Cotton Mill. Watchman discovered fire in the unpro-

tected roof space over dust room. A large amount of ice and snow on the roof greatly retarded the fire brigade, as it was very difficult to open up roof to play water at seat of fire. Sprinklers operated but had no effect because fire was above them. Fire extinguished by brigade, with moderate loss.

S-27005. Linoleum Factory. The watchman failed to discover this fire and when it was first noticed by firemen it was burning fiercely. He immediately blew whistle, the employees, members of fire brigade living near property, responded and laid one line of hose. The town volunteer company also responded, but the building was completely destroyed.

H-15157. Roofing Factory. Fire occurred in the small fuel oil furnace house and communicated through a wooden bridge to roof of main plant before private brigade could get their hose streams on fire. They succeeded in extinguishing fire in main plant before fire department arrived. The roof of furnace house was burned off and the walls so weakened that they were torn down. Loss, $4,000.

Organized Brigades.

SUCCESSFUL.

H-15425. Car Wheel Works. This fire occurred in laborer's shanty probably from smoking and had spread by a hollow frame partition to blind attic above before discovered. Private fire brigade chopped holes in ceiling and put fire out with hose streams and chemical extinguishers. Small loss.

H-15676. Petroleum Refinery. Lightning struck a steel tank. Employee discovered fire and summoned private brigade by factory whistle. Steam through a two-inch steam jet was turned on but failed to check fire because wooden roof of tank had ignited. Fire was fought from windward side with hose stream and extinguishers and although the intense heat caused steel walls of tank to collapse the oil was confined to enclosure around tank and was finally extinguished by the brigade.

H-16472. Wood Alcohol Plant. Private fire brigade turned out upon the blowing of fire whistle by watchman and with two hose streams completely extinguished fire, caused by defective wiring on motor.

H-15468. Metal Worker. Fire occurred in stave dry kiln and made a very hot fire. Brigade used hose streams and chemical extinguishers and succeeded in holding fire to small one-story building of origin, and finally extinguished it. The building was slightly damaged and the stock of staves was entirely consumed.

H-15238. Metal Worker. Fire started in a one-story frame addition to plant which had been practically idle for two years. Fire was discovered by two men who were testing a boiler. The fire brigade of a neighboring plant immediately responded and had a line of hose on fire before public department arrived. The main plant, a high one-story frame building, was saved by the quick action of the private brigade.

H-15389. Metal Worker. Fire started from fuel oil furnace and ignited the frame wall of office nearby, spreading to roof. Before public department arrived the fire had been entirely extinguished by private

brigade with hose streams and chemical extinguishers. The office walls are now covered with cement plaster on metal lath.

H-16225. Oil Refinery. Fire caused by leakage of hot oil from defective pet cock in still. The plant brigade was called. The flowing stream of burning oil was caught in and led through a 2-inch pipe to a covered drain. Loss, $250.

S-27263. Cotton Mill. While a batch of cotton noils were being run through the picker a bale tie in the stock struck a spark, igniting the picked cotton. Sprinklers opened and extinguished the original fire. Fire had meanwhile flashed back from picker to a pile of roving waste. The plant brigade extinguished this secondary fire with two chemical extinguishers.

S-25729. Cotton Mill. Fire discovered on the napper was sucked into the lint collecting pipes and blown through collector on roof, feeding on accumulated lint and intensified by two large fans, quickly destroying screen chamber and opening many sprinkler heads. When fans were stopped, fire flared back through the collecting pipes, igniting lint on the nappers. Hose streams were brought into the mill from either end by mill brigade, the fire pump started, and the fire apparently extinguished. The indicator valve on sprinkler system was closed. Fire had meanwhile worked up through a wooden partition near screen chamber and five minutes later broke out again. A third hose stream was used in completely extinguishing the fire. A large amount of goods was damaged, mostly by water.

Points of Interest from Fire Reports.

These notes are intended to illustrate conditions making for or against the effective control of fire.

Automatic Sprinklers.

S-24762. Paper Mill. Owing to high air pressure on the dry system and the fact that the carpenter shop where fire occurred was at the extreme end of a long run of 2½" pipe, the sprinklers were not very effective. A repair man working with his lantern had gone to the shop to get more kerosene. Kerosene and gasoline are both kept in buried tanks just outside shop; pumps bring the oil into the shop. Setting down his lantern about three feet away, he drew a little oil to make certain he had the right pump. As he did so, the drip pan blazed up. Fire pails were directly over the fire, but could not be reached. Two hose lines aided by the sprinklers prevented the fire from spreading beyond shop.

S-25335. Rag Shop. Fire occurred on the first floor, rear stairway, in pile of burlap bags from careless smoking. One head within two feet of the blaze did not open because of the air draft under the incline. One head at the top of stairway operated and held fire in check. Poorly constructed single board enclosures allowed the fire to burn through cracks and ignite bales on the other side of partition. One hose line was used to extinguish fire.

S-23568. Machine Shop. Small steel shavings had been thrown out of the window until a large pile had accumulated up against the building. An employee was burning some rubbish nearby when the fire ignited the oil on the steel shavings. Being so close to the building, the fire spread quickly up the outside to the cornice and in through the windows. The engineer immediately turned on the open sprinklers; in addition, twenty-two heads opened inside, and aided by four public hose streams extinguished the fire. The sprinklers did very efficient work, the loss being held to $2,500.

S-24476. Metal Worker. Day fireman just coming on his shift about 5.30 A. M. discovered fire around a 10-gallon can containing a small quantity of kerosene. Fire flashed to woodwork nearby, opening three heads, which with a few pails of water extinguished the fire. Upon inspection the next day, the sprinkler system was found with the gate valve sealed shut. The man in charge was not familiar with the system, and had sealed the valve shut when he had first assumed charge some three months before. Fortunately, the fire occurred in basement, and there was water enough in the piping to do the work.

S-24070. Woodworker. The watchman notified by sprinkler alarm discovered a sprinkler operating in shavings room apparently without reason. The water was shut off, the head replaced, and water turned on again. Soon a second head opened. This operation was repeated again, and also a third time. No smoke or fire was discovered. The water was left shut off the last time and a man stationed in room where fire occurred to open valve if fire showed. An investigation the following day revealed that behind an old knocked down tank piled against a brick wall, dust had accumulated and had been ignited possibly from a spark. There was still fire in the dust when rubbish was cleaned away. No claim was made. This fire illustrates the excellent work of the sprinklers in holding in check a fire which was not entirely out ten hours after the protection was shut off.

S-25200. Mercantile. Fire occurred in basement in a small room occupied by porter. Porter's coat was hanging on a wood partition where fire originated. Directly over porter's coat was a sprinkler head, which opened and entirely extinguished fire. Damage slight.

Alarm Service.

S-23630. Tenant Manufacturing. Fire occurred in a small room on fourth floor used for varnishing military swaggersticks, probably from spontaneous ignition of oily waste. The system at this property is normally dry pipe, and when last inspected water was found on system, with alarms out of service. A contractor was called to put air on system and restore alarms to service. Some time during the night dry valve tripped, but electric alarms failed. First notification from an employee about 6.40 A. M. No fire loss, but considerable damage from water to tenants on floors below.

S-24131. Grocery. Fire started in baled waste paper on second floor. Central station received a low air pressure and water flow signal at 6.44 P. M., and instead of notifying fire department they sent a runner. Eight minutes later an outsider telephoned fire department. Twenty-six sprinklers opened, but could not entirely extinguish fire between piles of paper. Fire damage about $10; water damage at least $10,000.

S-25341. Tenant Manufacturing. Fire occurred in excelsior on sidewalk from careless smoking and spread to excelsior on elevator. One sprinkler at top of well operated, extinguishing fire. A thermostat within six inches of head did not operate because it was adjusted to open at 175°, while the sprinkler was a 155° head. Neither the alarm valve connected to rotary gong nor the circuit closer connected to central station operated, and it was subsequently found that the hole in the ring seat of alarm valve was obstructed by some oakum which prevented water reaching the retarding chamber.

S-25731. Electrical Appliances. Fire occurred on the fifth floor in the vestibule of the freight elevator in a wire cage filled with rubbish, probably from spontaneous ignition, and was extinguished through the operation of one sprinkler. Water from the sprinkler

wet the thermostat directly above so that it operated for two rounds only, giving a trouble signal. The central station having received previous trouble signals from this property caused by whitewashers sent a man instead of fire department. As there was no sprinkler alarm, the water ran unchecked until discovered by an outsider, who telephoned the Protective Department. The water ran down through five floors, causing considerable damage to stock.

Watchman Service.

S-14946. Print, Dye and Bleach Works. Fire started from unknown origin about 5.30 A. M. on the second floor of the frame finishing building, completely gutting this building and spreading to finishing building via a frame passageway, although a 1¾-inch wooden door, tinned on one side and located at the printing building end, held the fire for some time, thus reducing the loss to the printing building. The new watchman was ignorant of the location of fire alarm box, and wasted valuable time trying to reach different employees by telephone. An outsider turned in alarm to fire department. Loss over $50,000.

S-25328. Sisal Warehouse. Shortly after midnight an outsider discovered fire creeping up west wall of this building, which is under government supervision. The sergeant in charge was awakened and immediately pulled a manual box. When department arrived at 1.24 A. M. fire was burning through roof and sprinklers were in operation. Four hose lines were laid. Firemen were only able to find the valve controlling the south system, the water being allowed to run on the center and north systems until a former watchman could be summoned, arriving about 5 A. M. Fifty-two sprinklers in all operated. The most severe fire was at center of building, where one sprinkler head was found plugged. The lack of watchman service and crippled sprinkler alarms were responsible for tardy discovery of fire and excessive water damage.

S-24172. Weaving Mill. Fire was confined to one warp filled with cotton yarn placed on floor near the windows in basement. Some time during the night a cigarette or match was probably thrown through a broken window pane, igniting warp. When employees arrived the next morning the paper covering of warp had been entirely burned off and the thread of warp badly scorched. No sprinklers opened. There is one station in basement, and watchman should have discovered fire had he made his rounds properly.

S-25202. Canning Factory. Watchman found a box of rags, used for wiping cans, smouldering. He stamped fire out with his feet and removed box from building. No apparatus used. An excellent record for watchman's service.

S-24710. Metal Worker. During a severe electrical storm, lightning struck outside wires, jumped lightning arrestors and burned out the interior of an oil switch. Watchman on regular round discovered fire and extinguished it with a bucket of water. No damage outside of switch, although watchman received a shock which surprised but did not injure him.

Fire Causes.

These fires are selected to illustrate defects either of construction or superintendence in the classes of property indicated.

Gasoline and Oil.

H-14938. Mercantile. A kerosene heater "exploded" in the "shoe shine parlor" in the rear of building. The flaming kerosene carried the fire through to the dry goods store in front, and almost completely destroyed a $25,000 stock of goods, also damaging the fixtures heavily. Fire extinguished by city chemical apparatus.

H-14361. Oil Refinery. An employee was filling a supply truck with gasoline. He had already filled the front and rear compartments, and the middle compartment was full to within a foot of the top when he reached over to turn the screw cock on the loading crane, reducing the size of stream. A slight explosion occurred when his hand touched the screw cock. He had almost extinguished the ensuing fire with a chemical extinguisher when the middle compartment overflowed, the flowing gasoline immediately spreading to the surrounding tanks, completely destroying five of them. Since the employee was not a smoker and no open flames were allowed, the only probable cause advanced for the explosion is a static electric spark discharge due to the contact of his hand with the screw cock and the contact of his body with the truck.

H-15533. Steel Works. Fire occurred about noon in a one story detached frame building used as a smithy. Hammer man was working a piece of cold steel when it snapped off, part of it hitting a pipe leading to oil burner in nearby forge. The pipe broke and the escaping oil ignited at the forge. Employee turned in alarm, but as the fire alarm system was usually tested around noon, the fire department did not respond. The building was entirely destroyed.

Oily Material.

S-23724. Mercantile. First notification of fire from the supervisory system. Fire department arrived 15 minutes later and found fire entirely extinguished by two sprinkler heads. Fire started among a pile of greasy burlap bags on the floor under which a steam pipe was located. The steam pipe undoubtedly provided the initial heat for spontaneous ignition.

S-24585. Candy Factory. On the afternoon of the fire a dressing was applied to the third floor of the warehouse where cartons and paper boxes were stored. A cloth was used to apply the dressing, and a jute bag by the workman to kneel on. This bag had become saturated with the oil and doubtless caused the fire which spread to the neighboring cartons. Fire was discovered about 9 P. M. from the

outside, the watchman having omitted his 9 o'clock round. Four sprinkler heads operated and extinguished fire before the arrival of the fire department.

H-14185. Airplane Factory. A rag saturated with gasoline and used to clean the doped wings was ignited apparently from a charge of static electricity. The fumes trapped in the hollow space between the linen coverings of the wings exploded. Employees and private fire brigade extinguished fire with hand chemicals after three wings were destroyed.

S-25371. Millinery Shop. The proprietor was preparing her evening meal in the back of the shop, using an alcohol chafing dish placed on a box of expensive hats. A short time before, while filling the lamp, some of the alcohol had leaked down the sides of the lamp. When she applied a match, the lamp flared up. She easily extinguished the blaze with a bucket of water before the sprinklers operated, but the hats in the pasteboard box were ruined by the water.

Electrical.

S-24581. Bleachery. A neutralizer bar connected to a small transformer on the wall was located on the delivery end of the dry cans to carry off the static electricity from the cloth. The insulation had become worn, resulting in a short circuit. A spark dropped into a box truck of goods directly underneath and ignited. One small hose stream was used to extinguish fire.

S-25434. Cotton Mill. Employee on first floor was brushing down lint on ceiling with a broom when he broke an incandescent lamp, the lint on the broom catching fire and spreading to ceiling. The fire ran through two 1-inch holes in plank floor to blanket storage room on floor above. Fire was extinguished by two sprinklers on first floor and by a hand hose on the second, with no sprinklers operating. About 2,500 single blankets were burned.

H-14934. Mercantile. A severe electrical storm had put the lights out of commission. Clerk was sent to basement to secure some merchandise with a candle. Fire spread through basement to adjacent buildings. Loss about $70,000.

Gas.

S-25222. Dentist's Laboratory. A small gas stove on bench was connected by ordinary rubber tube to gas pipe. Gas leaking from tube near stove ignited, burned off rubber tube, and ignited woodwork. Fire was extinguished by water from sink with very little damage.

S-24407. Ice Cream Factory. Fire occurred in the fire-resistive building used as a garage, storage and power house. The engine room extended along the entire south side of building, and was cut off from garage. No basements except two 32 x 40 foot spaces, one located in corner of building at east side of engine room used as valve header and coal storage room, and a similar space in opposite corner of building used as a boiler room (sprinklered). Two small

compressed air tanks are located in 5-foot unsprinklered tunnel which runs between the two small basement portions, not cut off. The return steam heating line from factory runs through this tunnel, and the 1½-inch gas line from street to the gas engine in engine room runs about halfway through tunnel. At 7.15 A. M. engineer heard an explosion in the tunnel, and the lights went out. He started to investigate, entering the tunnel at the end farthest from the boilers, and not detecting any odor of gas, returned to get a candle. (Note: The boilers are fired with a forced draught with fan in boiler room, thus creating a draught through tunnel towards boilers.) Evidently the safety valve on the air line to air tanks had been removed, and an excess air pressure had burst one tank, which in turn had broken the gas line and return steam line. When engineer reached bottom of stairs, the gas ignited from his lighted candle, burning him badly and flashing back to the broken pipe, there burning like a torch. Four sprinklers operated at end of tunnel in boiler room, but were not a factor. The flame melted the insulation on the wiring in conduit, but did no further damage. After burning fifteen minutes, gas was shut off at curb line. Temporary wiring was installed to light the plant, sprinkler protection was restored, and the safety valve in air line replaced. Damage to wiring about $800.

S-24478. Printing Establishment. On the second floor where fire occurred there are twenty-two 350 candle power globe gas lights which are all provided with pilot lights left burning at all times for convenience. Two weeks previously an extra light had been installed, a ½-inch connection being made from the 1¼-inch feed line, which connection extended about eleven feet along the ceiling to the light, and which was supported by two clip hangers with 1-inch screw nails in lead expansion shields in the concrete ceiling. The screw nails were too short and did not engage shields properly. The presses in this room were operated until midnight, and when the last employee left he pulled the chain which controls the gas light, loosening the hangers. Some time later the light fell, breaking off the ½-inch pipe at the feed main. When the room became saturated with escaping gas, it ignited from the pilot lights left burning, and an explosion followed. Twenty-three sprinklers operated, and when the fire department arrived, summoned by the supervisory company, the fire was quite extinguished. Small fire damage, but considerable from water to stock on floor below.

Miscellaneous.

S-25186. Metal Worker. Fire occurred in a ventilating pipe from a fan which blows air into a hood over apparatus used for coloring brass and copper articles. This work is done in a small cut off room by tumbling the articles in revolving drums with nitric acid, the drums being heated by gas. Both the hood and duct were made of wood covered with asbestos board. This wood had become oxidized by the action of the acid fumes and was readily ignited, probably by a spark from the gas heated tumblers. The duct was torn out and fire put out by one hand chemical.